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Rubber Research Scheme

(Ceylon.)

IMPERIAL BUR...
16 MAY 1930

Eighth Report of the Executive Committee

TO THE

Members of the Rubber Research Scheme.

PROCEEDINGS DURING THE YEAR

1929.

To be presented at the Ordinary General Meeting

April 25th, 1930.

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Rubber Research Scheme (Ceylon).

Peradeniya,
14th March, 1930.

NOTICE.

Notice is hereby given that the eighth Ordinary General Meeting of the Rubber Research Scheme (Ceylon) will be held in the old Legislative Council Chamber, Colombo, on the 25th of April, 1930, at 11 a.m. for the following purposes:—

1. To receive and consider the report of the Executive Committee for the year ended December 31st. 1929, and the annual Statement of Accounts and Balance Sheet as at December 31st, 1929.

2. To receive and consider reports by the technical officers of the Rubber Research Scheme.

3. To receive and consider report of the London Advisory Committee.

4. To elect auditors for the coming year and fix their remuneration

5. To transact any other business that may arise.

By Order.

J. I. GNANAMUTTU,
Secretary.

Committees of the Rubber Research Scheme

as at December 31st, 1929.

EXECUTIVE COMMITTEE:

Dr. W. SMALL, M.B.E., M.A., B.Sc., Ph.D., F.L.S., *(Acting Chairman).*
THE HON'BLE MR. C. W. BICKMORE, *(Actg. Colonial Treasurer).*
THE HON'BLE MR. C. E. HAWES.
MR. D. S. CAMERON.
„ D. DAVIDSON.
„ C. E. A. DIAS, J.P.
THE CHAIRMAN, PLANTERS' ASSOCIATION OF CEYLON.
MR. W. COOMBE.
„ ALLEN COOMBE.
„ J. FARLEY ELFORD.
„ CLIFFORD FIGG.
„ G. B. FOOTE.
LT-COL. T. Y. WRIGHT.
MR. J. I. GNANAMUTTU *(Secretary)*.

TECHNICAL COMMITTEE.

DR. W. SMALL, Acting Director of Agriculture, *(Acting Chairman)*.
„ J. C. HUTSON, Entomologist, Department of Agriculture, *(on leave)*.
MR. F. P. JEPSON, Acting Entomologist, Department of Agriculture. *(Acting)*.
„ A. W. R. JOACHIM, Chemist, Department of Agriculture.
„ M. PARK, Acting Mycologist, Department of Agriculture.
„ L. LORD, Economic Botanist, Department of Agriculture, *(on leave)*.
MR. T. H. HOLLAND, Manager, Experiment Station, Peradeniya, *(acting for Mr. Lord)*.
THE HON'BLE MR. J. W. OLDFIELD, *(on leave)*.
MR. H. W. ROY BERTRAND, F.L.S.
„ C. E. A. DIAS, J.P.
„ L. P. GAPP.
„ T. E. H. O'BRIEN, Chemist of Scheme.
„ R. A. TAYLOR, Physiological Botanist of Scheme.
„ R. K. S. MURRAY, Mycologist of Scheme.

Mr. J. I. GNANAMUTTU *(Secretary)*.

LONDON ADVISORY COMMITTEE:

Representatives of Rubber Growers' Association ...	Mr. P. J. BURGESS, M.A., F.C.S., *(Chairman)*.* „ ERIC MILLER. „ HERBERT WRIGHT.*
Representatives of Ceylon Planting Interests ...	SIR STANLEY BOIS. MR. G. H. MASEFIELD.*
Representatives of Rubber Manufacturing Companies ...	MR. W. C. SMITH * „ W. A. WILLIAMS * DR. D. F. TWISS, F.I.C. F.I.R.I.*
Representative of the Research Association of British Rubber & Tyre Manufacturers	LT-COL. J. SEALY CLARKE.*
Representatives of Imperial Institute	LT.-GEN. SIR WILLIAM FURSE, K.C.B., D.S.O.* LT.-COL. SIR DAVID PRAIN, C.M.G., C.I.E., F.R.S.*
Botanists	PROFESSOR V. H. BLACKMAN, F.R.S.* MR. H. N. RIDLEY, C.M.G., F.R.S.* MR. F. A. STOCKDALE, C.B.E., M.A., F.L.S.* MR. J. MITCHELL, A.R.C.Sc.*
Secretary	MR. J A NELSON, B.Sc.*

*Members of Technical Sub-Committee.

Auditors:—DUNCUM, WATKINS, FORD & CO., COLOMBO.

Offices:—RUBBER RESEARCH SCHEME, PERADENIYA. SECRETARY, J. I. GNANAMUTTU.

Bankers:—NATIONAL BANK OF INDIA, LTD.

Research Laboratories:—CULLODEN ESTATE, NEBODA.

Experiment Station:—Nivitigalakele, Matugama.

Scientific Staff:

CEYLON.

MR. T. E. H. O'BRIEN, M.Sc., A.I.C., (Chemist), Chief Technical Officer.
MR. R. A. TAYLOR, B.Sc., Physiological Botanist.
MR. R. K. S. MURRAY, A.R.C. Sc., Mycologist.

LONDON.

MR. G. MARTIN, B.Sc., A.I.C. F.I.R.I., Chemist, (Superintendent).
MR. W. S. DAVEY, B.Sc., A.I.C., F.I.R.I., Chemist.
MR. F. L. ELLIOTT, F.I.C., F.I.R.I., Chemist.
MR. L. L. STEWART, Laboratory Assistant.

EXECUTIVE COMMITTEE'S REPORT TO MEMBERS FOR THE YEAR 1929.

The Executive Committee of the Rubber Research Scheme (Ceylon) submits its report for the year ended December 31st, 1929.

Membership.—A complete list of members is given in appendix A to this report. It will be noted that at the end of 1929 there were 104 Rubber Growers' Association members and 112 Rubber Research Scheme members, making a total of 216. This represents a reduction of six members, there having been a loss of nine subscribers and an accession of three.

Subscriptions.—The subscriptions received from local subscribers on account of the year 1929 amounted to Rs. 35,969 as compared with Rs. 34,633 on account of 1928. This improvement, notwithstanding the smaller membership, is due to a higher output of rubber from certain estates. In view of the anticipated passing into law of the Rubber Research Scheme bill during 1929, it was decided to recover local subscriptions in quarterly instalments. It is satisfactory to note that the instalments have been received punctually. The same method is being followed in 1930. The annual Government grant of Rs. 67,500 was continued in 1929 and the Rubber Growers' Association paid into the London account its annual contribution of £2,000.

Executive Committee.—The Acting Director of Agriculture (Dr. W. Small, M.B.E.) continued to act as Chairman, pending the arrival of a successor to Mr. F. A. Stockdale. Mr. G. P. Madden resigned from the Committee in January when he left for England and Mr. A. Hollingworth of Messrs. George Steuart and Coy, filled the vacancy until July when he resigned. Lt. Col. T. Y. Wright went on home leave in September and it was resolved that his place should not be filled during the period of his absence. Mr. J. Farley Elford resumed his seat on the Committee upon his return to the island in December.

Six meetings of the Executive Committee were held, the dates being February 22nd, April 19th, May 10th, July 19th, October 18th, and December 20th. Copies of the printed minutes of these meetings have been circulated to all members of the Rubber Research Scheme.

London Advisory Committee.—The London Committee lost the valuable services of Sir Edward Rosling, who resigned owing to ill-health, and of Sir John Farmer who removed from London on retirement. Professor V. H. Blackman, F.R.S., filled the latter vacancy while Mr. F. A. Stockdale and Mr. James Mitchell joined the Committee on their taking up permanent residence in England. The Committee held four meetings during the year, on January 25th, April 26th, July 19th, and October 25th. Copies of the minutes of these meetings have been issued to all members of the Executive Committee. The reports of the London Advisory Committee and of the technical officers working at the Imperial Institute, London, are attached.

Technical Sub-Committee (London).—Meetings of this Committee were held on January 25th, April 26th, July 19th, and October 25th. Copies of the minutes of these meetings were circulated to the members of the Technical Committee in Ceylon.

Technical Committee (Ceylon).—The Acting Director of Agriculture continued to act as Chairman of the Technical Committee, and Mr. Malcolm Park, Acting Mycologist, Department of Agriculture, continued to serve on the Committee. Mr. C. E. A. Dias was nominated a member of the Committee in June. Mr. H. W. Roy Bertrand rejoined the Committee in July and Mr. L. P. Gapp and Mr. L. Lord were nominated in October. Mr. T. H. Holland, Manager, Experiment Station, Peradeniya, replaced Mr. Lord in December. Mr. F. P. Jepson has served on the Committee during the absence of Dr. J. C Hutson on home leave from October.

Meetings were held on five occasions, February 22nd, June 8th, August 22nd, October 18th, and December 20th. Copies of the minutes of the meetings were circulated to the members of all Committees of the Scheme.

Technical Sub-Committee (Ceylon).—A Sub-Committee consisting of Dr. W. Small (Chairman), Hon'ble Mr. J. W. Oldfield, Mr. C. E. A. Dias, Mr. L. P. Gapp, Mr. L. Lord, Mr. R. A. Taylor and Mr. J. Mitchell, (Secretary) was appointed by the Executive Committee on 19th July to consider the policy of the Department of Agriculture and the Rubber Research Scheme in the development of rubber budding work on their experimental stations and the means of giving advice to and guiding the budding and selection work of the rubber industry. Mr. H. W. Roy Bertrand joined the Sub-Committee in August. The Sub-Committee met on July 26th, August 7th, and August 22nd. Its recommendations were adopted by the Executive Committee and have been published in the Third Quarterly Circular of 1929.

Director of Research.—The impending retirement of the Organising Secretary was considered by the Executive Committee at a meeting convened on May 10th and it was resolved that, in view of the developments which had taken place in recent years, particularly in respect of budding and seed selection for the production of high-yielding strains of rubber, the growing menace of *Oidium* leaf-fall disease, and the need for field experimentation and soil work, a Director of Research with knowledge and experience of budding and selection work and of modern methods of field experimentation was a necessity. Pending the reorganisation of the Scheme, Mr. T. E. H. O'Brien, Chemist, has been recognised temporarily as the Chief Technical Officer.

Secretary.—Mr. J. Mitchell, Organising Secretary, left the island on October 9th, and retired after having served the Scheme for eight years and a half. The Executive Committee recorded its appreciation of the work Mr. Mitchell had done for the Research Scheme and the rubber industry of Ceylon and assured Mr. Mitchell that he carried with him its best wishes for the future.

Consequent on Mr. Mitchell's retirement, the Executive Committee decided to share with the Coconut Research Scheme the services of a secretary-accountant, who would be accommodated at Peradeniya. Mr. J. I. Gnanamuttu, Office Assistant to the Director of Agriculture, was seconded by Government for service in the combined post of Secretary to the Rubber and Coconut Research Schemes for a period of one year in the first instance. Mr. Gnanamuttu assumed duties on 1st October.

Technical Staff.—The three technical officers of the Scheme at Culloden were on duty throughout the year.

Subordinate Staff.—The question of regrading the clerical staff was considered and deferred until the adoption of the recommendations of the Government Salaries Committee. A readjustment was made of the scale of pay of the laboratory attendants at Culloden.

Accounts.—The audited statement of accounts and balance sheet for the year 1929 are given in Appendix F of this report.

A liberal amount has been written off for depreciation of buildings, apparatus, and furniture.

It will be noted that the expenditure inclusive of depreciation charges exceeds the income by Rs. 1,801-31.

The balance sheet shows cash on fixed deposits, current account in hand and in London amounting to Rs. 47,345-44 as compared with Rs. 65,516-71 at the end of 1928. From this balance the sum of Rs. 619-86 is earmarked for sundry creditors as compared with Rs. 3,435-69 at the end of 1928, leaving a net balance in the General Fund of Rs. 46,725-58 to be carried forward to 1930 as compared with Rs. 62,081-02 brought in.

During the year a further sum of Rs. 11,848-69 was spent on the Experiment Station, Nivitigalakele, the development account for which now stands at Rs. 58,748-68.

Replanting and Rejuvenation of Old Rubber Areas.—Attention to replanting and rejuvenation of old rubber areas has been given by the Technical Committee. At its instance Mr. Taylor drew up a tentative scheme of experiments, which has been discussed exhaustively and among other points settled was that complete removal of trees in areas to be rejuvenated was desirable. An offer by Mr. Gapp of 3½ acres of land for tapping-to-death experiments on different systems for a period of three months was accepted with thanks.

Rubber Budding and Seed Selection.—Much attention to budding and seed selection work was given by the Technical Committee of the Scheme and by the Technical Sub-Committee (Ceylon). The work of the latter has been mentioned. At the instance of the former Committee, the Physiological Botanist of the Scheme has undertaken to compile a booklet on budding for the guidance of local planters and to carry out experimental work in rejuvenation and replanting of old areas of rubber. The Scheme is prepared to advise and help its members in the latter operations and it has already had occasion to draw attention to the importance of obtaining as much revenue as possible from the heavy tapping of old areas which are to be rejuvenated. Special attention has been given by the Physiological Botanist to the selection of mother trees on estates and it is hoped that new interest has been aroused and that the necessity for finding the best mother trees in the island has been realised.

It was intimated by Government that land at Paspolakande for rubber research work under the Rubber Restriction Fund was not available, and steps were taken to reserve an area in the Matugama district. The establishment of isolated seed gardens for selection work, also under the Rubber Restriction Fund, has been delayed by the lack of available land on estates, but it is hoped that the difficulty has been overcome with the help of the Conservator of Forests. The difficulty of skilled supervision for the gardens and for carrying out pollinating work remains. It is hoped it will be solved by the passing into law of the Rubber Research Ordinance.

The question of testing mother trees for estates which had placed restrictive conditions on the use of material therefrom was reviewed by the Technical Committee which was of opinion that the Scheme, having secured the material on certain conditions, could not depart from its undertaking unless released from its obligations by the proprietors concerned. All estates which had supplied budwood were thereupon asked if they wished to continue their restrictions and the majority have agreed to allow the Research Scheme a free hand in regard to the disposal of budwood.

Heating Apparatus for Smoke Houses. —The installation of a heating apparatus for smoke houses was approved by the Executive Committee. It was ascertained from England that the erection of the installation and a boiler house would cost Rs. 6,000. Thereupon an alternative scheme submitted by Mr. O'Brien to enable him to make further tests before deciding on the large-scale production for which the installation was required was approved. A smoke house 10 feet square by 12 feet high with a capacity for approximately 550 sheets was erected near the laboratories and a small vertical boiler was purchased from Messrs. Walker Sons and Coy., Ltd. The cost of this equipment was Rs. 1,520.

Telephone Service.—Upon the Ceylon Government taking over the district telephone system, a telephone service was installed at the laboratories at a yearly rental of Rs. 200.

Plastometer.—The London Committee recommended the purchase of a plastometer for use in Ceylon. The Executive Committee considered that, as there was little storage of rubber in Ceylon, tests of the effects of storage on rubber need not be undertaken by the Research Scheme.

Motor Car.—Upon the retirement of the Organising Secretary, the Executive Committee resolved to dispose of the Scheme's motor car. In the absence of any offers in response to advertisement, it was decided in December to sell the car by auction.

Telegraphic Address of the Scheme.—The abbreviation *Rubrs* was adopted from the end of 1929 as the telegraphic address of the Scheme.

Booklet on the Preparation of Plantation Rubber.—The Committee approved of the publication of an edition of 1,000 copies of Mr. O'Brien's booklet on the preparation of plantation rubber at a cost of Rs. 885. Copies were supplied free to members of the Scheme and 322 copies were reserved for sale at Rs. 2-50 per copy. The Committee considers this

a most useful and well-compiled publication and is of opinion that it should find its way to all rubber estates in Ceylon.

Colonial Agricultural Conference.—The Committee considered a proposal to hold a Colonial Agricultural Conference in Ceylon in 1932 and resolved to co-operate in the arrangements and to give facilities to the delegates to visit the laboratories at Culloden.

Mr. Martin's Visit to Ceylon.—Mr. G. Martin, B.Sc., A.I.C., F.I.R.I., Chief Chemist of the Scheme in London, spent the period May 20th to September 11th in Ceylon after attending the Rubber Conference in Java and visiting Malaya. Mr. Martin worked in the laboratories at Culloden on the preparation of special samples of rubber and also visited estates in the company of Mr. O'Brien. At meetings of the Executive Committee and the Technical Committee on July 19th and on August 22nd respectively Mr. Martin gave a lucid account of the work he and his colleagues were doing in London and of the practical objects of that work.

The Committee voted a total sum of £369-17-0 to meet the cost of Mr. Martin's passage to the east and incidental expenses.

Mr. Lord's Visit to Java.—Mr. L. Lord, Economic Botanist, Department of Agriculture, represented the Rubber Research Scheme at the Rubber Conference in Java. A sum of Rs. 750 was voted by the Scheme to meet part of the expenditure incurred by Mr. Lord.

Visitors.—The laboratories were visited by Dr. Tempany, Director of Agriculture, F.M.S., Dr. Went of Utrecht University, Dr. P. J. S. Cramer of Dunlop Plantations, and about seventy superintendents and assistant superintendents of estates.

PROGRESS OF WORK.

1. ORGANISING SECRETARY.

In addition to secretarial duties and periodical visits to the laboratories and the experiment station, Mr. J. Mitchell visited twenty-five estates prior to his retirement from the Research Scheme in October, and furnished full reports for the information of the superintendents, agents and directors.

A report by Mr. Mitchell giving his conclusions regarding the general condition of Ceylon estates is attached, but the following is a summary.

Root Diseases.—The general position with regard to root diseases was considered to be satisfactory. Improved methods of treatment which are practised on the majority of estates have proved effective in preventing the spread of *Fomes lignosus* and securing its eradication.

Ustulina zonata continued to be prevalent, but in many cases tree-to-tree examinations resulted in its detection at an early stage of development. The concrete filling method advised by the Research Scheme proved very successful wherever practised and should be more generally adopted.

Bark Rot.—The improved position with regard to bark rot was maintained and most estates reported almost complete absence of the disease during the year. This disease

should cause no anxiety if the methods advised by the Research Scheme are carefully carried out.

Brown Bast.—The series of addresses which were given to Planters' Associations during 1928 resulted in a widespread adoption of the methods recommended and a considerable amount of excellent work has been carried out in all districts.

Special care is required in carrying out the treatment during wet weather and protection of the treated surfaces is essential.

A large number of trees treated during 1927 were brought into bearing during the year and have continued to give satisfactory yields.

Leaf Diseases.—An outbreak of secondary leaf-fall (*Phytophthora* sp.) occurred on many estates during July, but the defoliation was checked by the intervention of dry weather conditions before serious damage resulted.

It is considered that serious defoliation as a result of this disease can be effectively prevented by regular applications of nitrogenous fertilisers.

Oidium leaf-fall continued to spread in all districts and has assumed serious proportions in the drier districts. Recommendations for effective prevention of the disease cannot be made until results are obtained from the extensive experiments which are being carried out by the Mycologist.

General Problems.—Considerable interest was shown by superintendents in problems relating to factory efficiency, budding of rubber, and replanting and rejuvenation of old areas. There was a diminution in manuring programmes owing to the depressed condition of the industry, but there is no doubt that these will be renewed when financial conditions permit.

2. CHEMIST.

Mr. T. E. H. O'Brien's report is attached, but the following is a summary of the problems which have received attention.

Curing of Sheet Rubber.—Investigations were continued on the subject of alternative methods of curing sheet rubber. Before considering the installation of a large-scale apparatus for drying rubber by means of heat from steam pipes, it was decided to construct a half-scale drying house in which further experiments could be carried out. A building 10 feet × 10 feet × 12 feet high was constructed near the laboratories and equipped with a boiler and steam piping. Experiments were conducted in this drying house during the latter part of the year, considerable attention being given to control and measurement of ventilation.

Air-dried sheet rubber has a characteristic stickiness which is not present in smoked sheet, and which is considered to be due to oxidation during drying. Brokers' reports from London make no reference to stickiness, but it is regarded as a distinct drawback to the sale of this grade of rubber on the local market. It should be mentioned that since the end

of the year experiments have indicated a method of treatment which is likely to be effective in the removal of the stickiness referred to.

It was found that sheets (containing paranitrophenol to prevent fermentation), if hung to air-dry at ordinary temperature for the first seven days after rolling, dried completely in a further four days when transferred to a smokehouse or hot air drying room. It is considered that this method can be developed to provide a means for preparing sheet rubber with the appearance and properties of normal smoked sheet but with a very considerable reduction in consumption of firewood.

Surface Mould and Fungal Spots in Crepe.—The prevention of development of surface mould and fungal spots in crepe by addition of a small quantity of paranitrophenol to the latex was further investigated. It was found that discoloration only occurs if the crepe is exposed to *direct* light during drying. This can be prevented by shading the windows of the drying shed or by hanging the crepe to dry in the form of "mats" which are hung sufficiently high from the floor to escape direct light from the windows.

Samples for the Imperial Institute.—A large number of samples was prepared and forwarded to the Imperial Institute for examination by the London staff of the Research Scheme. Approximately half the samples were prepared in connection with investigations which are in progress in Ceylon, and the remainder were required by the London Committee for the researches which are being carried on at the Imperial Institute.

Mr. G. Martin, Superintendent of the Research Scheme in London, visited the east during the year and was stationed at the Culloden laboratories for three months. Mr. Martin assisted in the preparation of a number of the samples referred to above, and the opportunity was taken to discuss matters of interest connected with the investigations in progress in Ceylon and at the Imperial Institute.

Miscellaneous Investigations.—Experiments on the effect of iron on the colour of crepe rubber indicated that small proportions of iron are not likely to have an important influence.

A preparation marketed as "Mouldex" for prevention of mould in smoked sheet was examined. It was found to be less effective for the purpose than paranitrophenol, and was unsuitable for use in crepe manufacture owing to the yellow colour which it imparts to the rubber.

Samples of white crepe rubber prepared by fractional coagulation were examined at the Imperial Institute and were also submitted to brokers for valuation. It was concluded that this rubber had no special properties or enhanced market value which would at present justify its preparation as a separate grade.

A case of discoloration of crepe rubber supposed to be due to adulteration of the latex was investigated. Attention is drawn to the possibility that discoloration of crepe which cannot be traced to other causes may in some cases be due to adulteration.

3. PHYSIOLOGICAL BOTANIST.

Mr. R. A. Taylor continued his duties as Physiological Botanist and officer-in-charge of the Experiment Station, Nivitigalakele. His report is attached, of which the following is a brief summary.

Experiment Station, Nivitigalakele.—The programme of cultivation and manuring which was initiated has been reflected in improved growth of the trees and cover crops. The station now bears a good cover of leguminous plants with the exception of a few patches on the exposed portion of the 1928 clearing. *Calopogonium mucunoides* and *Centrosema pubescens* have given the most successful results as ground covers. Of the taller growing plants *Crotalaria usaramoensis*, *Tephrosia candida*, *Desmodium gyroides*, *Clitoria cajanifolia*, and *Indigofera arrecta* have grown well. The green manure plants were pruned twice during the year and the loppings buried.

Gliricidias were planted out to minimise wind damage and have grown well in some areas. Albizzias have not proved very successful.

Experiments were made on preparation of Adco synthetic farmyard manure. The experiments were very successful and much valuable humus matter has been added to the soil.

Removal of jungle stumps was discontinued on the advice of the Technical Committee, except where these are on or close to the terraces.

The station was inspected by a visiting committee of the Executive Committee during May. Mr. Roy Bertrand has now been appointed to visit the station four times annually and he made his first visit during November.

Budding was carried out at suitable times during the year. Improved success has been obtained following on the improvement in the growth of the trees, but the results are influenced by the fact that many of the plants budded during the year were those which had failed to bud successfully previously. The greater part of the 1926 and 1927 clearings has now been budded successfully.

The budwood nursery has been further developed and now contains representatives of eighty different clones.

Mother Trees.—The method of keeping yield records of mother trees was discussed by a special sub-committee and it was decided that yields should be recorded in ounces of dry rubber per tapping.

Ninety estates have supplied budwood or are keeping records in collaboration with the Research Scheme, and records are forwarded quarterly.

A large number of the trees was personally inspected during the year, and arrangements are being made for the remainder to be inspected early in 1930.

Brown Bast.—A report discussing experiments which have been carried out and putting forward a new theory of the cause of the disease was published in *The Tropical Agriculturist* for June 1929.

The method of treatment recommended by the Research Scheme was observed to give good results where carried out carefully. A study was made of the efficacy of this treatment as compared with isolation without scraping. It was concluded that the latter method is not suitable where an area of bark of more than a few inches in diameter is affected.

Manuring of Rubber.—The manuring experiment on Arapolakande Estate was completed and a report was drawn up. The lay-out of the experiment did not allow of the statistical treatment of the results by the latest methods and no significant increase in yield can be recorded. Definite benefit on foliage and bark renewal can be reported as a result of manuring with nitrogenous material either alone or in combination with phosphates and potash.

A scheme for a further manuring experiment was drawn up and has been fully considered by a special sub-committee. It is proposed that the experiment shall be continued for ten years as it is considered that the benefit of manuring on foliage and bark renewal must eventually be reflected in increased yield.

Replanting of Old Areas.—Considerable time was given to study of the above subject and a tentative report, which was circulated to agents and others as a basis for discussion, resulted in much information on the subject being accumulated.

One of the most important problems from an economic point of view is the question of the best means of obtaining the maximum yield from the old trees before removing them. A number of estates are conducting experiments on replanting without reference to this important factor.

The disposal of timber is also likely to be a problem on many estates with poor transport facilities and the possibility of breaking down timber into Adco synthetic farmyard manure has been considered. Small-scale experiments on this treatment are being carried out.

4. MYCOLOGIST.

Mr. R. K. S. Murray continued his duties as Mycologist. His report is attached, of which the following is a summary.

Oidium Leaf Disease.—The replies to a questionnaire circulated to all subscribers to the Research Scheme show that *Oidium* was more prevalent in all districts than in 1928 and in certain mid-country districts it is a serious menace to the health of the rubber.

It is concluded that there is little correlation between rainfall and the occurrence of the disease but there is evidence of a direct correlation in certain districts.* Trees growing in poor soil and on exposed ridges suffer more severely than trees in the richer hollows.

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* This opinion is that of the Executive Committee. It differs from that of the Mycologist given on page 31.

Experiments have been initiated to test

(1) the value of nitrogenous manuring as a means of minimising the effects of the disease and the value of potash manuring as a means of increasing the resistance of the leaf to infection,

(2) the value of spraying with Sulfinette as a direct control measure against the fungus.

The experiments are being conducted at Kandanuwara Estate, Matale, where *Oidium* is very severe. The plots have been laid out in accordance with statistical requirements and yield records are being kept to determine whether the sprayed areas show increased yields. It is intended to continue the experiments for five years.

Arrangements have been made to carry out experiments on control of *Oidium* by means of dusting with sulphur powder. A power machine, the Bjorklund duster, has been imported for the purpose and work will be started early in 1930.

Disease of Bud Shoots.—A new disease of young shoots of bud-grafted rubber was investigated. The young shoot is attacked a few inches below the extremity resulting in a blackish sunken area down one side of the shoot.

A strain of *Phytophthora palmivora* (*P. Faberi*) was isolated and established by inoculation experiments as the causal fungus. The strain belongs to the rubber group of the species but is a larger-spored form than any strain hitherto recorded.

The fact that in all cases so far reported the disease originated on material imported from Java suggests that this fungus may have been imported from the latter country.

Bark Rot.—A field experiment on the control of bark rot was carried out during the south-west monsoon for the purpose of obtaining information regarding the best time of application and the most suitable period between successive doses. Owing to the almost complete absence of the disease both from treated and control trees no results were obtained.

Rust on Vigna.—The rust disease of *Dolichos Hosei* (Vigna) caused by *Uromyces* sp. was further investigated. The occurrence of pycnia and aecia on the affected leaflets together with urediniospores establishes the fungus as an autoecious species.

It is concluded that the leaf-fall caused by the disease can be a serious factor in thinning a cover of Vigna, especially under very dry weather conditions, but the Vigna recovers on the advent of wetter weather.

Disinfection of Imported Budwood.—In view of the probable importation of large quantities of budwood from other countries it has been considered desirable to find an effective and harmless method of disinfecting such material to guard against importation of disease. Experiments have been commenced but have not yet reached a stage for report.

Snails on Vigna.—The Kalutara snail (*Achatina fulica*) continues to do much damage to areas of Vigna and no satisfactory method of control has yet been devised.

The Atlas-lime treatment introduced by Mr. Roy Bertrand is reported to have been successful on some estates, but controlled experiments on two estates have given disappointing results. Further experiments with Atlas preservative are to be undertaken.

Attempts to keep snails in captivity in order to study the effects of different poisons have proved unsuccessful.

5. RESEARCH WORK AT THE IMPERIAL INSTITUTE.

A full report on the work carried out by the London Advisory Committee at the Imperial Institute is attached.

Mr. Martin, the Chief Chemist in London, attended the Rubber Conference held in Java in May, 1929, and subsequently visited the Rubber Research Institute and various rubber estates in Malaya. He also spent twelve weeks in Ceylon where he worked at the Research Scheme laboratories. Whilst in the colony he attended a meeting of the Executive Committee and discussed with it the objects of the work in London.

The study of the causes of variation in plasticity was continued, and the results so far obtained suggest that it is mainly due to inherent differences between latex from different groups of trees. Work on this subject will be continued in 1930.

A comprehensive investigation is in progress to determine (1) whether rubber from a single estate is uniform throughout the year, (2) whether rubber from a large estate is more uniform than that from a small estate and (3) whether stricter supervision of factory operations effects an improvement. This is part of a larger investigation to determine the cause of abnormalities on some estates.

The properties of sheet dried in air at various temperatures also received considerable attention. Preliminary samples examined were not altogether satisfactory and the subject is being further investigated in conjunction with Mr. O'Brien.

The London Advisory Committee forwarded the following reports during the year:—

(*a*). Effect of organic accelerators of vulcanisation on the variability of rubber (published in the 1st Quarterly Circular, 1929).

(*b*). The determination of the plasticity of rubber (published in the 1st Quarterly Circular, 1929).

(*c*). Crepe prepared by fractional coagulation.

Rubber Research Scheme Bulletins.—One bulletin was issued during 1929 viz., Bulletin No. 50, Crepe Rolling, by Mr. T. E. H. O'Brien.

Rubber Research Scheme Quarterly Circulars.—Circulars dealing with questions affecting the industry continued to issue at quarterly intervals. Their appearance in

The Tropical Agriculturist and notice of them in the press broadcast them to a large circle of readers. Attention is drawn to the following subjects specially dealt with in these Circulars:—

The possibility of latex becoming contaminated with Bordeaux mixture as a result of spraying operations.
The determination of the plasticity of rubber.
The effect of diluting latex on the plasticity of crepe.
The effect of organic accelerators of vulcanisation on the variability of rubber.
The effect of coagulum in serum on the plasticity of smoked sheet.
Brown bast treatment.
An indirect method of measuring the amount of foliage on different blocks of trees.
The occurrence and significance of *Oidium* leaf disease in Ceylon.
Rubber budding and selection.
A disease of young rubber buddings.
Streakiness in blanket crepe.
Diseases of rubber in Ceylon 1929.

Rubber Growers' Association Bulletins.—The bulletins published by the Rubber Growers' Association were issued by the Scheme to all estates which do not receive them direct from London. The following special articles appeared:—

January.	Rubber roadways.
	Rubber upholstery.
February.	Rubber roadways.
	Rubber flooring.
March.	Onazote.
April.	Annual general meeting of the Rubber Growers' Association.
May.	Rubber-covered platforms on brewery wagons.
	Central Health Board, F. M. S.
June.	Rubber Roadways annual meeting.
	Report upon the relative vibration-absorptive properties of certain types of rubber.
July.	Suitability of sponge rubber for upholstery.
	Rubber in Borneo.
August.	Rubber in the automobile industry.
	The Ross Institute.
September.	Rubber Growers' Association propaganda.
	Native rubber cultivation in Netherlands East Indies.
	Central Health Board.

October.	Rubber at the Canadian National Exhibition.
	Rubber in automobiles.
	Rubber Research Institute of Malaya.
November.	Rubber in the automobile industry.
	The Ross Institute.
	The value of reclaim.
December.	Rubber roadways.
	Rubber in the automobile industry.

Meetings.—The thanks of the Rubber Research Scheme are due to the Chamber of Commerce for the free use of their rooms for various meetings of the Committees of the Scheme, and for the courtesy shewn by the Secretary and his staff at all times.

Adopted by the Executive Committee at its meeting held in Colombo on March 14th 1930.

(Signed) W. SMALL,
Acting Chairman,
Rubber Research Scheme (Ceylon).

PERADENIYA,
1st. March, 1930.

ORGANISING SECRETARY'S REPORT ON VISITS TO ESTATES.

The present report covers the period ending September 30th 1929, and the views expressed represent the writer's opinion of the general condition of estates in Ceylon during that period. Tours of estates situated in all the rubber-growing districts were carried out and reports were issued for the information of the superintendents, agents and directors of the estates visited.

1.—ROOT DISEASES.

The position of *Rhizoctonia bataticola* as a possible primary factor in the causation of root diseases of rubber is still undecided and consequently it is again necessary to deal with root diseases under the names already in use.

(a) **Fomes lignosus.**—It is pleasing to record that further improvement in the condition of estates has been noted and that the treatment now being practised on the majority of estates is proving successful not only in checking the spread of the disease but also in securing its eradication.

(b) **Fomes lamaoensis.** (brown root disease).—Most estates report deaths from this cause but there has been no serious outbreak and the position with regard to this disease has been normal.

(c) **Ustulina zonata.**—As in previous years the number of deaths recorded from this cause has been relatively high as compared with other root diseases. A considerable amount of tree-to-tree inspection work has been carried out and it has been possible to locate large numbers of cases in an early stage of development. The concrete filling method advised in Research Scheme Quarterly Circular No. 4. of 1925 has proved very successful wherever practised and should be more generally adopted. Further observations confirm the view that it is the most satisfactory method at present known for the treatment of collar rot caused by *Ustulina zonata.*

(d) **Poria hypobrunnea.**—This disease is of very rare occurrence and no cases were observed during visits to estates.

(e) **Sphaerostilbe repens.**—This disease was again reported from areas which had suffered from floods but very few deaths occurred.

2—STEM DISEASES.

(a) **Stripe Canker or Bark Rot.**—The improvement recorded in the last annual report has been maintained and most estates report the almost complete absence of this disease during the year. Most of the cases noted during visits to estates were in outlying sections where supervision was difficult and it is the writer's opinion that if the method advised by the Research Scheme is carefully carried out and is adequately supervised this disease should cause no anxiety on any estate.

(*b*) **Patch Canker (claret-coloured).**—This disease has been noted on several estates but in no case was any serious injury caused thereby. In this connection the writer is of the opinion that the procedure advised by the Research Scheme is calculated to keep this disease under effective control.

(*c*) **Die-back (Diplodia** sp.).—A few cases of this disease have been reported and observed but no serious outbreaks have occurred.

(*d*) **Pink Disease (Corticium salmonicolor).**—This disease occurred on young trees on one estate but it would still appear to be of small importance in Ceylon.

(*e*) **Brown Bast.**—The series of addresses which were given on this subject during 1928 resulted in a widespread adoption of the treatment advised and a considerable amount of excellent work has been carried out in all districts. Though it is too early to report what degree of success has resulted from the work done it is pleasing to note that very few cases of failure owing to the intervention of rains during treatment have been reported. The further observations carried out confirm the view that special care is necessary during wet weather and treated surfaces require to be protected. During the year a large number of trees treated during 1927 have been brought into bearing and have continued to give satisfactory yields. A note on this subject was issued in the Second Quarterly Circular for 1929.

3.—LEAF DISEASES.

(*a*) **Secondary Leaf Fall (Phytophthora** sp.).—In the early part of July there was an outbreak of this disease on many estates and it was feared that serious defoliation would occur but the intervention of dry weather conditions checked the disease and there was no recurrence. It is the writer's opinion that regular applications of nitrogenous fertilisers will effectively prevent serious defoliation and that it is important to keep the trees in as good condition as finances will allow if the ill effects of this disease are to be prevented.

(*b*) **Oidium Leaf Fall.**—This disease continued to spread in all districts and has now assumed more serious proportions in the drier districts. The Mycologist of the Research Scheme has carried out a series of manuring and spraying experiments and the problem is being thoroughly studied from every standpoint. Until these experiments have been concluded it is not possible to make any recommendations which can be guaranteed to check the disease.

4—.GENERAL PROBLEMS.

(*a*) **Manufacture.**—Considerable interest was shown in the problems of factory efficiency following on the publication of Research Scheme Bulletin No. 50 on Crepe Rolling and there is reason to believe that many improvements will be effected by the adoption of the recommendations contained therein.

(*b*) **Budding of Rubber** —Very great interest was taken in this subject by all estate superintendents and a considerble amount of correspondence was dealt with during the

year. There can be no doubt that this section of rubber-growing has now secured a foremost place in the attention of the Ceylon planting community and previous apathy on the subject appears to have passed away.

(*c*) **Replanting and Rejuvenation of Old Areas.**—This problem has been much discussed and advice given as to the lines on which experiments can best be carried out. Several estates have undertaken programmes of replanting on the lines suggested.

(*d*) **Manuring of Rubber.**—Owing to the depression in the industry there was a diminution of manuring programmes but there can be little doubt that these will be renewed when conditions allow.

(*e*) **Cover Crops.**—As in previous years the principal cover crop grown was *Dolichos Hosei* (Vigna) and considerable areas in all districts bear a good cover of this plant. The Kalutara snail has again been responsible for considerable loss of this cover crop and experiments to check the depredations of the snails have proved only partially effective.

(Signed) J. MITCHELL,
Organising Secretary.

18-1-1930.

CHEMIST'S REPORT FOR 1929.

CURING OF SHEET RUBBER.

Shortage of firewood for smoking continues to be felt on many estates and considerable interest has been shown by rubber producers in the experiments which are in progress at the laboratories on the subject of alternative methods of curing sheet rubber. It is interesting to note that the situation may be entirely changed within the next few years if replanting of old rubber areas is taken in hand in Ceylon to any great extent. In this case supplies of firewood would be assured for some years to come, as replanting programmes would doubtless be spread over a considerable period.

In Chemist's report for 1928, it was mentioned that arrangements were being made for a steam heating apparatus to be installed in an estate smokehouse. After further consideration it was decided that it would be preferable to construct a half-scale installation at the laboratories so that experiments could be carried on without involving any interference with estate routine. A building 10 ft. by 10 ft. by 12 ft. with a capacity of approximately 550 sheets was constructed and fitted with a boiler and steam pipes. Careful attention was paid to control of ventilation with a view to obtaining data regarding the amount of air movement which is necessary to ensure efficient drying of the rubber with the minimum expenditure of fuel. Hitherto no reliable information on this subject has been available and ventilation of smokehouses has been based entirely on personal opinion.

Measurements of air movement were made in the experimental drying room without rubber present and will be repeated later on with the room full of rubber. At a temperature of 100°F air movement amounted to five complete changes of air per hour and the speed of the air passing out through the top ventilator was found to be approximately 3 miles per hour. It will be of interest to see whether this amount of ventilation is sufficient for efficient drying when the room is full of rubber, as it is considerably less than the ventilation provided in many smokehouses.

Up to the present the room has been used for preparation of a comprehensive series of samples which have been dispatched to the Imperial Institute for an investigation of the properties of sheet rubber prepared and cured under different conditions.

Experiments have shown that sheet rubber dried in hot air without smoke has a characteristic stickiness which is not present in smoked sheet. The stickiness appears even when drying is carried out at a comparatively low temperature such as 95—100°F., and in fact sheets dried at ordinary temperature during the hot part of the year also have this stickiness. Brokers' reports from London on samples of air-dried rubber make no reference to stickiness, which probably diminishes during storage in a temperate climate, but in the writer's opinion it would be a distinct drawback to the sale of this grade of rubber on the local market and would be likely to cause " massing " of the sheets in the chests during transit.

It has been shown that the stickiness of air-dried sheet can be increased or decreased by addition of certain chemicals to the latex, but up to the present no substance has been found which can compare with wood smoke for preventing sheet rubber becoming sticky during drying at raised temperature. It is interesting to find that wood smoke thus plays a definite part in the " curing " of sheet rubber, apart from colouring the rubber and acting as a disinfectant. Not only does wood smoke prevent sheet rubber from becoming sticky during drying but smoked sheet does not become sticky if afterwards kept at a raised temperature in absence of smoke. Perhaps more remarkable is the fact that rubber which has become sticky during air-drying loses the stickiness to a great extent if afterwards exposed to wood smoke.

It is probable that the stickiness which develops in air-dried sheet is caused by oxidation of the caoutchouc, and it seems possible that wood smoke contains traces of some anti-oxidant substance which prevents this oxidation taking place. Mainly, however, it is thought that wood smoke has a lubricant effect in masking the presence of stickiness, as shown by the fact that an air-dried sheet loses its stickiness when exposed to smoke.

Pending further investigation the proposal to introduce air-dried sheet to the market as an estate grade is being held in abeyance and attention is being directed to preparation of a semi-smoked sheet which has the appearance and characteristics of smoked sheet but can be prepared with considerably greater economy in the use of firewood than ordinary smoked sheet.

In the course of the experiments it has been found beneficial to keep the sheets (containing P.N.P. to prevent fermentation) at or only slightly above normal temperature for the first few days after rolling. Thereafter, when transferred to a smokehouse or hot-air room, drying is completed remarkably quickly. For example, sheets kept at ordinary temperature for seven days after rolling dried completely in four days when transferred to a room at a temperature of 100°F. whereas sheets placed directly in the warm room after rolling took ten days to dry. This phenomenon is doubtless due to the fact that in the former case the surface of the sheet remains soft during the early stages of drying and permits internal moisture to escape readily, whereas in the latter case a hard skin is formed through which internal moisture must force its way.

The above method of drying points a way to very considerable economy in firewood if the sheets can be sufficiently coloured by four days' smoking, or if a part of the colour is provided by addition of a small proportion of a phenolic substance to the latex with the coagulant. It is proposed to make extended trials on these lines and it is hoped that a procedure, suitable for use under estate conditions, will be devised whereby sheet rubber of standard appearance and quality can be produced with a very low consumption of firewood.

Another point which has been noticed is that the texture of the rubber has a considerable influence on the rate of drying. Sheets rolled at a certain estate factory took fifteen days to dry in the experimental drying room, owing to the presence of obstinately

slow-drying corners and edges, whereas sheets of equal or greater thickness rolled at the laboratories dried out evenly in ten days. The dilution of the latex and other details of coagulation were the same in both cases and the variation in rate of drying is attributed to differences in handling and rolling the coagulum.

PARANITROPHENOL (P. N. P.) FOR PREVENTION OF SURFACE MOULD AND FUNGAL SPOTS IN CREPE.

In Chemist's report for 1928 it was reported that addition of P. N. P. to latex in the proportion of 1 part to 4,000 parts rubber had been found effective in preventing development of mould or spots in blanket crepe during storage. This treatment has also been shown to be effective in preventing development of mould and fungal spots in thin crepe during drying, which is a not uncommon occurrence in Ceylon factories during wet weather. This small proportion of P. N. P. is not sufficient to prevent growth of mould under severe laboratory tests, but is considered to be sufficiently effective under estate conditions. The treatment has been adopted by a number of estates during the past year with excellent results.

A drawback to the use of P. N. P. mentioned in last year's report was that under certain conditions the crepe becomes discoloured. Careful tests have shown that such discoloration is caused by the action of light. If crepe containing P. N. P. is exposed to direct window light during drying it becomes distinctly discoloured, and this is very apparent when the crepe is rolled to blanket. The discoloration is only caused by the direct rays of light, and if the rubber is effectively protected from direct light during drying it is equal in appearance to ordinary blanket crepe. Incidentally, it was observed that ordinary crepe also becomes discoloured if exposed to direct light during drying, but to a less extent than crepe containing P. N. P.

Direct light can be excluded from the drying room by fitting shades to the windows, but it has been found equally effective to hang the rubber to dry in the form of mats such as are usually prepared when crepe rubber is to be dried artificially. When hung on the reapers the mats of crepe are high above the floor and direct light from the windows does not fall on the rubber. The mats contain 2—3 layers of crepe and the size and thickness is adjusted so that the reaper carries the same weight of rubber which would be hung in the ordinary way.

It might be thought that the mats of crepe would take a long time to dry out, but in practice it is found that they dry as quickly as crepe hung in single strands. This method of hanging greatly improves the circulation of air through the drying room and can therefore be recommended for rooms which are badly ventilated. It is the stagnation which occurs in the middle of many drying rooms which leads to development of mould and this is avoided by hanging the rubber in the form of mats.

Another advantage is that most of the surplus water drips from the crepe while it is being rolled on to the drum to form the mat and very little water is transferred to the drying room. This also tends to prevent mould as it is considered that mould infection is

mainly centred in the floor boarding where it thrives on serum which drips from the rubber. Treatment of the floor with a 10 per cent. solution of Atlas A (Arsenical) Wood Preservative can be recommended as a further safeguard against mould infection from this source.

Trouble with mould in the drying rooms of Ceylon factories appears to be increasing each year, and this is considered to be due to gradual infection of factories which have previously been free from mould. Improvement in ventilation by hanging the crepe in the form of mats, the use of P. N. P. either temporarily or permanently and thorough disinfection of the floor boarding can be recommended as the best means of control, apart from increasing the temperature of the drying room artificially.

THE EFFECT OF IRON ON THE COLOUR OF CREPE RUBBER.

Some experiments were carried out to determine the extent to which the colour of crepe is influenced by the presence of iron in the water used for diluting the latex.

Dissolved iron occurs naturally in water only in very small quantities, or at least, if large quantities are present, the iron precipitates on exposure to air. In a series of tests on samples of water from estates the highest proportion of dissolved iron was 1: 3,000,000.

Samples of water were prepared containing ferric and ferrous iron (ferric chloride and ferrous sulphate) in the proportion of 1: 100,000. Latex diluted with these samples of water and made up into blanket crepe was not appreciably different in colour from a control sample, nor did the samples show a greater tendency to darken in colour during storage.

A sample of water contaminated with suspended iron from rusty pipes was procured and found to contain 1: 75,000 parts of iron. The water was bright red in colour and must be regarded as heavily contaminated. A sample of blanket crepe prepared from latex diluted with this water was distinctly off colour, but not more than would be expected from the direct effect of the colouring matter present. The sample did not show an abnormal tendency to darken during storage.

While the above experiments are insufficient to enable definite conclusions to be drawn, they strengthen the opinion that the effect of small amounts of iron on the colour of crepe is less important than it is sometimes supposed to be.

SAMPLES FOR THE IMPERIAL INSTITUTE.

During the year Mr. G. Martin, Superintendent of the Rubber Research Scheme Laboratories at the Imperial Institute, visited the East and was stationed at the Culloden Laboratories for three months.

The opportunity was taken to show Mr. Martin details of manufacture on a number of estates and to discuss matters of interest in connection with the investigations in progress in Ceylon and at the Imperial Institute. Mr. Martin also assisted in the preparation of a number of samples which were required in connection with the work of the Scheme in London.

During the year 125 samples totalling 1,000 lbs. were prepared and despatched to the Imperial Institute. Approximately half of the samples were sent at the request of the London Committee of the Scheme in connection with the investigations at the Imperial Institute, and the remainder were forwarded for report in connection with investigations in progress in Ceylon.

MISCELLANEOUS INVESTIGATIONS.

1. **Mouldex as a Mould Preventive.**—This substance, which is understood to consist of an emulsion of dinitro-o.-cresol, is used to some extent in other producing countries as a mould preventive in rubber manufacture. A series of experiments was carried out to compare the relative efficiency of Mouldex and P. N. P. for this purpose both in sheet and crepe manufacture. It was concluded from the tests that P. N. P. is more efficient than Mouldex and that no advantage would be gained by the use of the latter substance in Ceylon. The use of Mouldex in crepe manufacture would in any case be precluded owing to the yellow colour which it imparts to the rubber. The tests confirmed the results of previous experiments that mould growth in smoked sheet and crepe can be completely prevented by addition of P. N. P. to the latex in the proportion of 1 part P. N. P. to 1,000 parts dry rubber, or, in the case of smoked sheet, by soaking the freshly rolled sheets in a 0.1 per cent. solution of P.N.P.

2. **Crepe Rubber by Fractional Coagulation.**—Fractional coagulation of latex, which is customarily adopted in preparation of sole crepe, results in production of approximately 10 per cent. of dark coloured crepe (1st. fraction) and 90 per cent. of abnormally white crepe (2nd. fraction). Apart from the attractive appearance of the second-fraction rubber, it was thought that this crepe might possibly have special properties which would justify its production as a separate grade of rubber.

Samples of (*a*) ordinary crepe, (*b*) discoloured first-fraction crepe and (*c*) white second-fraction crepe were prepared and submitted to brokers in Colombo and London for valuation and to the Imperial Institute for a report on the quality of the rubber. The ordinary crepe and second-fraction crepe were both valued at full market price, but it was stated that the latter might under certain conditions secure a slight premium on account of its light colour. The first fraction rubber was valued at a discount of approximately 10 per cent.

A full report has not yet been received from the Imperial Institute but a preliminary report indicated that the samples were approximately equal in quality and that the white second-fraction rubber had no special properties which would justify its preparation as a separate grade at present.

3. **Adulteration of Latex,**—Some tests were carried out on an estate in connection with discoloration of crepe, which appeared to be due to adulteration of the latex by the tappers. On this estate coagulum from seven divisions was machined and dried in one factory, and, whereas the crepe from six divisions was perfect in colour, that from the other division became discoloured during drying or darkened rapidly in storage. Tests of various

factors in preparation which might account for the discoloration gave negative results and it was concluded that it was due to some form of adulteration of the latex. Microscopic examination and p H. tests of the latex from individual tappers revealed nothing of interest, but certain samples of latex when coagulated overnight without bisulphite became noticeably discoloured on the surface and the serum was pink in colour, suggesting the presence of some easily oxidisable substance. It is thought that adulteration of latex may be more common than is generally supposed and may be responsible for cases of discoloration of crepe which cannot be traced to other causes.

VISITS AND ADVICE TO ESTATES.

During the year visits were made to twenty five estates for the purpose of advising on manufacture, and full reports were furnished for the information of the superintendents and agents.

Numerous enquiries were dealt with on various subjects connected with manufacture, the total number of letters received in this connection being 178, which is approximately the same as in 1928.

VISITS TO THE LABORATORIES.

During the year the laboratories were visited by Dr. Tempany (Director of Agriculture F. M. S.), Dr. Went (Utrecht University), Dr. P. J. S. Cramer (Dunlop Plantations), and approximately seventy superintendents and assistant superintendents of estates.

PUBLICATIONS.

1. Crepe Rolling (R. R. S. Bulletin No. 50).

2. Guide to the Preparation of Plantation Rubber in Ceylon (published as a handbook).

3. Notes on Streakiness in Blanket Crepe (R. R. S 4th. Quarterly Circular for 1929).

SUMMARY OF WEATHER RECORDS AT CULLODEN LABORATORIES.

	1928.	1929.
Rainfall for the year ...	158.67 ins.	144.68 ins.
Highest monthly rainfall ...	29.03 „ (Nov.)	28.345 „ (May)
Highest daily rainfall ...	7.45 „	8.95 „
Highest shade temperature recorded (day) ...	94.5°F.	93.0°F.
Lowest shade temperature recorded (day) ...	76.5°F.	80.1°F.
Lowest shade temperature recorded (night)...	67.7°F.	64.4°F.

(Signed) T. E. H. O'BRIEN,
Chemist.

RESEARCH LABORATORIES,
CULLODEN ESTATE,
NEBODA.

27th. January, 1930.

PHYSIOLOGICAL BOTANIST'S REPORT FOR 1929.

The year 1929 has been largely spent on work which makes the official title of the writer appear somewhat out of place. Attention has been given largely to questions involving considerable field and office work. The various items will be mentioned under separate headings.

Experiment Station, Nivitigalakele.—Progress has been made all round on the station. The whole area is now completely planted up and a large portion of the 1926 and 1927 clearings has been budded. A table is given later. The growth, although poor in general, has improved to a great extent during the year, largely owing to the cultivation and manuring programmes carried out. From the point of view of growth the 1928 clearing promises to be best.

Except for one or two bare patches on exposed portions of the latest clearing the whole station carries a good cover of leguminous plants. *Calopogonium mucunoides* and *Centrosema pubescens* have proved the most successful among the creeping cover plants. *Dolichos Hosei* is showing fairly good growth in parts of the 1926 clearing and it was successfully established in certain difficult places by the coconut-husk method of planting recommended by the visiting committee in May. Of the taller plants *Crotalaria usaramoensis*, *Tephrosia candida*, *Desmodium gyroides*, *Clitoria cajanifolia and Indigofera arrecta* grow well. The following indigenous plants were found growing naturally and their spread has been encouraged, *Desmodium triflorum*, *D. heterocarpum*, *D. heterophyllum* and *Pycnospora hedysaroides*. The last has proved very useful on a rather exposed hillside on boulder land and it seeds freely. Stray seedlings of *Sesbania cannabina*, *Pueraria phaseoloides* and a *Tephrosia* (probably *villosa*) have been found growing, having it is thought been introduced with seed of the other plants. A velvet bean (*Mucuna nivea*) was tried but it cannot be recommended.

Considerable damage is suffered from wind. The Gliricidias put out have grown well in some areas, but the Albizzias on the whole have been a failure. Several methods of planting have been tried but the success has been meagre. Towards the end of the year three windbreaks have been planted with *Albizzia*, *Grevillea* and *Leucaena glauca*. By manuring these and encouraging growth it is hoped to alleviate matters; as it is, a large portion of the rubber is very stunted and a high percentage of success in budding cannot be expected. It may be of interest to record that 3-foot cuttings of *Gliricidia* proved much more successful than the longer branches frequently used. They were also much more economical of material.

As far as the rubber is concerned there has been no serious attack of any pest or disease. One or two plants were attacked by mites and *Oidium* and there were two cases of *Phytophthora* attack on budded shoots but all have been mild and easily controlled.

Certain of the cover plants were badly attacked by snails early in the year, but it was found possible to effect complete control by keeping a few ducks on the affected area. There are at present very few snails to be found and no evidence of damage.

Early in the year the original paddy field reservation partly surrounding the 1926 clearing was cleared and opened on the contour platform system. The land was used to accommodate some experimental marcots.

An attempt to multiply rubber vegetatively by a modification of ordinary marcottage was made and was attended with success. Various composts were used and all appeared to be equally good except those containing charcoal. The plants used were young; the use of older plants is not so satisfactory. Unfortunately a large percentage of the plants died after transplanting owing to the fact that an extensive period of dry weather supervened.

A programme of cultivation and manuring has been carried out all over the station. All the terraces have been pickaxed and the rubber and coverplants have been manured separately with mixtures recommended by the visiting committee. The tall-growing green manure plants have been pruned twice all over and in some areas three times. Loppings were either buried or mulched at the back of the terraces. In the contour trenched area the loppings were buried in the unfilled portions of the trenches between the plants, and on 13 acres of the 1928 clearing 50 pits per acre were dug to accommodate this material. The twining plants (*Calopogonium*, *Centrosema* and *Dolichos*) have caused a certain amount of trouble by climbing up the young trees. The ordinary weeding round was not sufficient to effect proper control and special coolies have had to be put on to clear the growths back.

Adco synthetic farmyard manure has been experimented with. The materials used have been green manure loppings, *cheddy* from the deniya land and boundaries, and weeds. The experiments were entirely successful and much valuable humus matter has been added to the soil. It was found that roofing over the stacks was uneconomic as water was not always at hand. This type of manure can be recommended where *cheddy*, straw, etc., are available but it is thought to be unnecessary to treat green manure loppings before digging in. These, if cut before they become too woody, decay rapidly and the use of the Adco system of stacks adds expense unnecessarily.

The jungle stumps remaining in the 1926 clearing have been largely removed, and a number of the terraces in the 1927 clearing has also been attended to. At a recent meeting of the Technical Committee it was decided that this work should be stopped except where the stumps are actually on or very near to the terraces.

Except for a small manure shed no new buildings have been erected during the year. The conductor's bungalow has had window shades erected and the front verandah has been partially enclosed. The old two-room line has been converted for the use of the two budders and suitable furniture has been supplied. Rice is now purchased from a neighbouring estate at a reasonable price and the loss previously experienced by the purchase of small quantities has been stopped.

Budding has been carried on at suitable times throughout the year. The success obtained is still not considered as high as it might be but the plants budded this year have very largely been those which had failed to take previously. Material from several new clones has been put out in the budwood nursery and there are now 80 clones represented there. Many of these will be used in the 1928 clearing and budwood is now ready. Budwood from this source has been supplied to Peradeniya during the year and quantities have also been used on the station. It has been found in most cases to be of superior quality to that obtained from pollarded trees. All budding is now done with the instrument devised in 1928.

Of 2832 selected seeds received from Peradeniya and Heneratgoda, 2,505 germinated. These have been put out to form a supply nursery for the 1928 clearing in which there are a number of poor plants. They will be budded in the nursery and put out as budded stumps. Supplying of this nature has been necessary in the 1926 clearing wherever it was found impossible to bud the original plants.

The station was inspected by a visiting sub-committee during May and by Mr. Roy Bertrand as Visiting Agent during November. The station was visited by numerous estate superintendents and by several research workers from other countries who were passing through Ceylon. Interest of local visitors has been confined largely to budding and budwood nurseries, but cover crops and to a limited extent contour planting have been enquired into. Five budders have been trained for estates and several others have spent a few days at the station to study the methods employed. The station budders have visited and given demonstrations on eleven estates.

Only a small number of coolies has been resident on the station. The figures are as follows :—

	Men.	Women.	Children.	Total.
On January 1st	10	8	2	20
Left during the year	6	4	1	11
Taken on	4	2	—	6
On December 31st	8	6	1	15

Local Sinhalese labour has been employed as required.

The permanent staff, Mr. S. B. O'Neil, conductor, and Messrs. Gunawardena and Kannangara, budders, have worked satisfactorily throughout the year.

The rainfall for the year has been as follows :—

January	4.90	inches.
February	3.38	,,
March	10.39	,,
April	19.20	,,
May	21.95	,,
June	11.50	,,

July	6.98	inches.
August	1.05	„
September	16.02	„
October	19.90	„
November	10.47	„
December	11.33	„
Total	137.07	„
For 1928	127.12	(eleven months)
„ 1927	148.80	inches.

TABLE SHOWING THE POSITION AT THE EXPERIMENT STATION AS REGARDS BUDDING.

1926 Clearing.

Scion.	Number of trees in the clone.	Number successfully budded.	Growing and sprouting.	Recent budding: dormant.	Supply plants available.
L. 1/15 ...	112	108	100	8	72
H. 2 ...	112	80	73	7	19
G. 771 ...	105	105	93	12	22
G 1836. ...	106	75	75	—	—
C. 4 ...	121	98	98	—	—
LAV 28 ...	95	94	82	12	—
C. 3 ...	75	70	62	8	22
C. 5 ...	110	93	93	—	10
ELAD 3 ...	98	72	41	31	33
ELAD 5 ...	99	96	75	21	28
St. G. 45 ...	124	79	79	—	—
J. 7 ...	10	8	8	—	—
DK. 19935 ...	3	3	3	—	—
J. 18 ...	9	9	9	—	—
H. 401 ..	20	9	9	—	—
W. 197 ...	22	17	17	—	—
DK. 3513 ...	3	3	3	—	—
17 ...	1224	1019	920	99	206

1927 Clearing.

Scion.	Number of trees in the clone.	Number successfully budded.	Growing and sprouting.	Recent budding: dormant.	Supply plants available.
ELAD 1 ...	102	89	85	4	53
YOG 21Y ...	110	63	44	19	20
ELAD 4 ...	109	92	72	20	63
YOG 1H ...	92	68	68	—	11
YOG 8Y ...	68	49	46	3	17
GL 11 ...	95	36	12	24	29
MIR 3 ...	120	61	42	19	3
PG 4849 ...	98	54	52	2	50
MIR 11 ...	53	25	25	—	36
MIR 2 ...	38	17	17	—	20
BS 5 ...	111	24	24	—	41
KOB 41 ...	83	49	38	11	29
FR 56 ...	75	37	31	6	9
MAD 110 ...	75	7	5	2	—
KOB 42 ...	122	75	67	8	36
PG 3183 ...	93	33	28	5	—
MK 10/2 ...	98	50	41	9	132
TAL 2 ...	75	24	13	11	6
18	1617	853	710	143	455

Mother Trees.—Details of many more trees are now available. Estates which are keeping records or have already supplied budwood now number ninety. On the recommendation of a sub-committee appointed to go into the question, the previous decision of the Technical Committee that yield records in cubic centimetres of latex were satisfactory was rescinded and returns are now made in ounces of dry rubber per tapping. Details as to length and height of cut are now obtained at intervals and a full description of the tree and its situation. A large number of the trees has been personally inspected and arrangements are being made to inspect the others early in 1930. Correspondence on this subject has been considerable.

As regards the obtaining of material from trees the same procedure as reported last year has been followed. When a new high-yielding tree which shows promise is discovered a branch is taken at as early a date as possible and used in the budwood nursery. By the time one year's yield records are available budwood is ready for use. Should the tree prove satisfactory it is then put out in the field. Pollarding with the attendant delays and interruption of yield recording is therefore avoided.

Brown Bast.—Work on brown bast has consisted of a short study of the variation in the diameter of latex vessels in individual trees. The point had a bearing on a theory of cause of the disease which was put up in 1928. The result of this together with a note describing the theory was published in *The Tropical Agriculturist* of June, 1929. Advisory work on treatment has been carried out as occasion demanded. The results of the scraping-cum-isolation method have been studied during visits to estates, and, where carried out carefully, the method is very successful. Trees scraped in 1927 are again in tapping on one estate.

A suggestion made at a meeting of the Technical Committee that the isolation method without scraping should be the subject of comparative tests was acted on. Approximately 200 trees were treated in this way on Gikiyanakande Estate where the other method had previously been successfully employed. An inspection made at the end of the year indicated that the method is not suitable where an area of bark of more than a few inches in diameter is affected. The isolation of large sections, while stopping spread, does little to effect a cure. Small areas after isolation can be tapped across and the final result is comparable with that of the other method. Isolation without scraping should prove suitable where the outbreak is observed before any great length of tapping cut has gone dry.

Manuring Experiments.—The manuring experiment on Arapolakande Estate was completed in February and a report was prepared. The lay-out of the experiment did not allow of the statistical treatment of the yield records by the most recent methods and no significant benefit from the point of view of yield can be reported. Definite benefit from nitrogenous manuring, both alone and in combination with phosphates and potash, can be reported on bark renewal and on head of foliage. Bark samples of normal bark at 3 feet and of renewing bark from the 1925 tapping panel were taken from all the trees and

measured by micrometer gauge, and the figures were analysed by recognised methods. The benefit was significant.

The head of foliage was examined by means of a piece of apparatus designed to measure the depth of shade under the trees in the different blocks. The method is fully described in the Second Quarterly Circular. Benefit in this respect was measurable in every plot receiving nitrogen.

In this experiment all plots including controls were forked annually and it is thought that this cultivation on land previously uncultivated had a very great influence on the yield, and during a short period trial such benefit was really greater than that obtained from the manure. The indications are that had manuring been continued for a longer period the benefits would have become apparent. As it is, the yield of the field, as a whole, has increased very considerably. Benefits to foliage and renewal of bark cannot but be reflected in yield at some time.

A scheme for a new experiment was drawn up during the year and submitted to the Technical Committee. Towards the end of the year a special sub-committee was appointed to consider the question of further experimental manuring. This committee met in Colombo in November and its proposals are now ready to be discussed by the Technical Committee. The proposed scheme was drawn up to study particularly the following points. (1) deficiency (2) effect of (*a*) acid inorganic (*b*) basic inorganic (*c*) organic nitrogen. The experiment is to be started during 1930 and the lay-out is such that all figures for yield, etc. can be analysed by recognised present-day statistical methods.

Replanting of Old Rubber.—This question has been the subject of considerable study and enquiries received were the cause of preparation of a tentative note on the subject. The circulation of this to certain agents and others as a basis for discussion was the means of much information on the subject being accumulated. A number of estates is taking up the matter on an experimental scale and several visits have been made to estates in this connection. Unfortunately most are not proposing to experiment on the best means of obtaining the maximum yield from the old trees before cutting out and replacing with budded material. To the mind of the writer a wrong impression of the costs will be obtained in this way. No extra crop to help balance the loss experienced during the unproductive period of the young plants is obtained. It is thought that overtapping for several years before removal will amply repay the extra trouble in organisation.

The disposal of the timber will present a problem for estates with poor transport facilities, and a tentative scheme for the conversion of at least part of this into Adco synthetic farmyard manure was put up to the Technical Committee. In this connection correspondence has been entered into with the Imperial Institute and indirectly with Messrs. Adco and manufacturers of disintegrators. Two estimates for disintegrators were received from firms and also suggestions for the special treatment of the particular material from Messrs. Adco. Unfortunately owing to lack of funds experiments on a large scale have had to be postponed. A small-scale experiment was tried in an iron drum but

the breaking up of the wood had to be done by hand and was unsatisfactory. After three months practically no breaking down of the wood had taken place. Another attempt is being made.

A small-scale replanting experiment is to be carried out on Mirishena Estate in co-operation with the Rubber Research Scheme. Here the trees are being heavily tapped for three months before removal. This period is short but it may afford information on at least what can be expected from the very heavy tapping period before cutting out.

A large number of estates has made enquiries regarding the laying down of budwood nurseries with a view to the possibility of replanting small areas in the near future.

Visits to Estates, etc.—Thirty six visits were paid to estates either in an advisory capacity or in connection with experiments. Seventy four visits were made to the Experiment Station, and all meetings of the Technical Committee and Technical Sub-Committee were attended. A lecture was delivered to the Southern Province Planters' Association in Galle.

Correspondence and Office Work.—Correspondence dealt with consisted of 567 inward and 528 outward letters apart from others delivered by hand. A considerable proportion was of an advisory nature and among others the following subjects were dealt with :— budding, training of budders, budwood nurseries, cover crops (their establishment, pests and utilization), cross pollination, mother trees, manuring, replanting and brown bast.

Articles published or prepared :—

A note on brown bast.

An indirect method of measuring the amount of foliage on different blocks of trees.

A note on the replanting of old rubber.

Budding of rubber and its meaning for Ceylon.

The last was prepared during the year but has not yet been passed for publication.

(Signed) R. A. TAYLOR,
Physiological Botanist.

RESEARCH LABORATORIES,
CULLODEN,
NEBODA.
17th January, 1930.

MYCOLOGIST'S REPORT FOR 1929.

1. **Oidium Leaf Disease.**—This disease is a serious menace to rubber in certain mid-country districts, and has received a great deal of attention during the year.

In May a questionnaire similar to that circulated in 1928 was sent to all estates subscribing to the Rubber Research Scheme. The replies are summarised and discussed in a paper published in the R. R. S. 2nd Quarterly Circular for 1929. They show that *Oidium* was more prevalent in all districts than in 1928. As regards the correlation of the intensity of the disease with environmental factors the replies were somewhat contradictory, but certain general conclusions may be formed and are set forth in the paper referred to above. Briefly it is concluded that there is little correlation between rainfall and the occurrence of the disease but that a relatively dry atmosphere, by favouring the production of spores, is conducive to severe attack.* This is suggested as an important factor to explain the greater severity of the disease in the drier Matale and Uva districts than in the wet low-country districts. As regards soil conditions there is little doubt that trees growing on poor washed-out soil and exposed ridges suffer more severely from the effects of the disease than trees in the richer hollows. There is no evidence at the present time of any inherent individual immunity or resistance to the disease, and any tree which produces its young leaves at a time when the fungus is active will be attacked.

Experiments have been put in hand during the year to test (1) the value of nitrogenous manuring as a means of minimising the effects of the disease, and the value of potash manuring as a possible means of increasing the resistance of the leaf to infection by the fungus, and (2) the value of spraying with Sulfinette (a lime sulphur preparation) as a direct control measure against the fungus. These experiments are being conducted on Kandanuwara Estate, Matale, where *Oidium* is very severe.

In the manuring experiment calcium cyanamide and synthetic urea are being used as sources of nitrogen, and muriate of potash as the source of potassium. The manures are being applied in randomised plots of 25 trees each, the treatments being replicated 5 times. It is intended to apply the manures once a year for at least five years. The manures were applied in January and again in December. To date there are no results to be reported.

In the spraying experiment varying quantities and concentrations of Sulfinette were used, the plots being laid out as far as possible in accordance with statistical requirements. In all about 23 acres were sprayed at an inclusive cost of Rs. 11/20 per acre. It had been intended to carry out the spraying shortly before general wintering commenced but owing to a delay in receiving the Sulfinette from England it was not possible to commence spraying until March 25th. by which time nearly all the trees had wintered, and on refoliation had been severely attacked by *Oidium*. As a consequence the spraying was not of much benefit, and the operations were regarded mainly as a preliminary trial of the method, attention

*See footnote on page 9.

being chiefly directed towards perfecting the technique in every possibly way. A full report on the spraying was written for the Executive and Technical Committees of the Scheme.

At the present time there is no reliable evidence of decreases in yield due to *Oidium*. In order to obtain information on this point yield records of the sprayed and control plots on Kandanuwara were started in July.

Arrangements have been made to carry out experiments on the control of *Oidium* by means of dusting with sulphur powder. A power machine, the Bjorklund Duster, which has been used with great success in this connection in Java, has been imported and work will be started early in 1930. Previous to obtaining the Bjorklund Duster from Java correspondence had for some time been held with firms in England and America, but so far they have been unable to supply a suitable machine. Several estates were visited in Matale and Uva with a view to finding suitable areas of rubber for the experiments, and it has been decided to experiment on 100 acres of Bandarapola Estate, Matale, and 80 acres of Gonakelle Estate, Passara, the superintendents of these estates having kindly offered to co-operate.

2. **Disease of Bud Shoots.**—A new disease of young shoots of bud-grafted rubber has been investigated. The young green shoot is attacked a few inches below the extremity resulting in a blackish sunken area down one side of the shoot. This extends chiefly in a downward direction and the whole shoot may be killed back. A strain of *Phytophthora palmivora* (*P. Faberi*) was isolated from a number of specimens and inoculation experiments established this fungus as the causal organism. The strain belongs to the rubber group of the species but is a larger-spored form than any strain hitherto recorded.

The importance of this disease as a factor in retarding the development of buddings is not yet known. There is evidence that it is dependent to a considerable extent on wet weather conditions. The fact that in all cases so far reported the disease has originated on material imported from Java suggests the possibility that this fungus has been introduced from the latter country. Enquiries have elicited the fact that the disease is known in Java though the fungus is apparently new to Ceylon.

Attention was drawn to this disease in a note published in the 3rd. Quarterly Circular for 1929.

3. **Bark Rot.**—A field experiment on the application of disinfectants in the control of bark rot was carried out during the S. W. Monsoon. It was designed to obtain information as to the best time of application and the most suitable period between successive applications of (1) Cargillineum Mixture *B* (10%) and (2) 5% Brunolinum Plantarium in water. Owing to the almost complete absence of the disease on control and treated rows no results were obtained.

A bark rot mixture which has subsequently been put on the market under the name "Candarsan" was tested in the field and reported on.

A strain of *Phytophthora palmivora* has been isolated from a piece of diseased bark. It is hoped to carry out inoculation experiments with this fungus to ascertain whether it is the causal organism of bark rot.

4. **Rust on Vigna.**—The rust disease on *Dolichos Hosei* (Vigna) caused by *Uromyces* sp. has been further investigated, and pycniospores and aeciospores of the fungus have been found. The pycnia and aecia occur on the under surface of affected Vigna leaflets, and their occurrence on this host together with urediniospores establishes the fungus as an autoecious species.

Observation made during the dry weather in August and the early part of September have led to the conclusion that the leaf-fall caused by this disease can be a serious factor in thinning a cover of Vigna especially under very dry weather conditions. No case has yet been found, however, where the cover is actually killed, and the Vigna recovers on the advent of wetter weather.

5. **Disinfection of Imported Budwood and Budded Stumps.**—In view of the fact that large quantities of budwood and budded stumps are likely to be imported into Ceylon from the further east in the near future, it has been considered desirable to find an effective and harmless method of disinfecting such material to guard against the introduction of new diseases. Experiments have accordingly been commenced but the work has not yet reached a stage at which a report may be issued.

6. **Snails on Vigna.**—The Kalutara snail, *Achatina fulica*, continues to do much damage in areas of Vigna, but no thoroughly satisfactory method of control has yet been devised. The Atlas-lime treatment advocated by Mr. H. W. Roy Bertrand has been found successful on some estates though controlled experiments which have been carried out during the year on two estates have given disappointing results. Attempts have been made to keep snails in captivity under as natural conditions as possible so that the effect of different poisons might be tried. In all cases, however, the snails have died. Further experiments with Atlas preservative are to be undertaken.

7. **Visits to Estates.**—Visits were paid to 20 estates for advisory purposes. In addition, 18 visits were made to the Experiment Station, Nivitigalakele, mostly in connection with experimental work.

In all, the number of days or portions of days spent away from the laboratories on other estates amounted to 101. A large proportion of this time was taken up by the spraying and manuring experiments in the control of *Oidium*.

8. **Disease Specimens and Enquiries.**—The number of disease specimens and enquiries which were dealt with amounted to about 90. In some cases the time spent was a few minutes while in others investigations occupying several days were involved.

9. **Reports.**—The following reports were submitted for publication during 1929 :—

(1) On the Occurrence and Significance of Oidium Leaf Disease in Ceylon. (Rubber Research Scheme 2nd. Quarterly Circular, 1929.)

(2) A Preliminary Note on a Disease of Young Rubber Buddings. (Rubber Research Scheme 3rd. Quarterly Circular, 1929.)

(3) Diseases of Rubber in Ceylon, 1929. (Rubber Research Scheme 4th. Quarterly Circular, 1929.)

(4) Pests and Diseases of Rubber, 1929 (Annual Report for 1929 of the Kalutara Planters' Association.)

(Signed) R. K. S. MURRAY,

Mycologist, Rubber Research Scheme,
(Ceylon.)

RUBBER RESEARCH SCHEME LABORATORIES,
CULLODEN, NEBODA.

January, 28th. 1930.

REPORT OF THE LONDON ADVISORY COMMITTEE FOR 1929.

The Committee and the Technical Sub-Committee each held four meetings during the year. A list of the members is given on the cover page.

The Committee regret to report the resignation on the ground of ill health of Sir Edward Rosling, who was largely responsible for the inauguration of rubber research in Ceylon and has always taken a very active interest in the work of the present and previous Schemes. The Committee also lost the valuable services of Sir John Farmer who removed from London on retirement from the post of Professor of Botany and Director of the Biological Laboratories at the Imperial College of Science and Technology. His successor, Professor V. H. Blackman, F. R. S., kindly undertook to fill the vacancy. Mr. F. A. Stockdale and Mr. J. Mitchell also accepted invitations to join the Committee on their return to take up permanent residence in this country, and their intimate knowledge of rubber planting in the Colony should be of considerable benefit.

Finance.—The expenditure incurred by the London Committee was £ 2,462. 5. 0 which included £ 108. 11. 11. in respect of apparatus etc. purchased on behalf of the Ceylon Committee. At 31st December, 1929, there was an unexpended balance in London of £ 460. 5. 9.

Staff.—No alterations occurred in the technical staff which consists of Mr. G. Martin, B. Sc., A. I. C., Mr. W. S. Davey, B. Sc., A. I. C., Mr. F. L. Elliot, F. I. C. and Mr. L. L. Stewart.

Mr. Martin left London in March to attend the Rubber Conference in Java at which a number of technical experts from various countries were present. He remained in Java for four weeks where, in addition to attending meetings of the Conference and of the Pacific Science Congress, he visited a number of estates and factories.

Mr. Martin also stayed for nearly three weeks in Malaya where the Acting Director of the Rubber Research Institute (Major B. J. Eaton) kindly devoted considerable time in accompanying him to various estates and factories, and discussing with him the work of the Institute and factory procedure.

Mr. Martin spent about twelve weeks in Ceylon during which period he was principally occupied in working at the Rubber Research Scheme Laboratories on the preparation of special samples, and in visiting estates in company with Mr. O'Brien. He also attended a meeting of the Executive Committee and explained the practical object of the work in London.

Mr. Martin resumed duty in London in October, 1929. Reports on a number of questions arising out of his visit were in preparation at the close of the year.

The Committee are of opinion that this visit will be of considerable benefit both to the Scheme and to Mr. Martin and will be undoubtedly helpful in promoting a much closer liaison between the work in the East and that in London.

Mr. Martin continued to serve as one of the representatives of the Research Association of British Rubber Manufacturers on the Joint Committee with the British Electrical Research Association appointed to investigate the properties of ebonite and other insulating materials.

Standardisation of Methods of Testing.—Following preliminary discussions with Major B. J. Eaton and Professor Dr. de Vries, whilst they were on leave in this country, as to the desirability of standardising methods of vulcanisation testing, a memorandum was prepared containing definite proposals as a basis for discussion. This memorandum, together with observations from manufacturers obtained by the Research Association of British Rubber Manufacturers and a summary of the technical literature connected with the subject compiled by the Association in consultation with the Committee, was forwarded to Professor de Vries for consideration at the Conference in Java. Arrangements were made at the Conference for a series of tests to be carried out by an agreed method by the Central Rubber Station, Java, the Rubber Research Institute, Malaya, and the London Committee, Ceylon Rubber Research Scheme, to determine whether the same results could be obtained at each of these Research Stations.

Investigations.—The use of first grade plantation rubber would be greatly facilitated in comparison with that of lower grades and reclaim if it were intrinsically uniform irrespective of its origin and during the year a series of investigations was commenced which should be of practical value in improving the general level of uniformity in Ceylon. These investigations consist of (*a*) preliminary experiments to confirm and amplify the results of previous tests which showed that rubber from single estates is uniform for long periods, to be followed by (*b*) an examination of rubber from a large number of estates to determine the origin of the material with abnormal properties and subsequently (*c*) experiments to determine the cause of these abnormalities (*i. e.* whether due to local modifications of the method of preparation or to intrinsic differences between latex from different groups of trees) with a view to making recommendations for action to be taken on estates.

The preliminary experiments on rubber from single estates referred to in (*a*) above have been arranged so as to determine at the same time whether rubber from a large estate is more uniform than that from a small estate, and whether stricter supervision of factory operations effects an improvement. The Committee is indebted to Professor de Vries who is kindly supplying samples of estate rubber from Java for comparison, and who is also co-operating in carrying out tests to determine the effect of storage in the tropics and in Europe. Over fifty samples have still to be examined and no general conclusions can yet be drawn.

Many manufacturers experience difficulty in plasticising and moulding to shape some consignments of first grade rubber. The same difficulty is not experienced with lower grades which are sometimes mixed with first grade material to decrease the difficulties of manipulation. Reclaimed rubber is also used for the same purpose. Information concerning the causes of variability in plasticity is therefore of considerable importance to the plantation industry and this subject has received intensive study in London for some time.

The investigation of the effect on plasticity of differences in the method of preparation referred to in the report for 1928 was completed, and the results indicate that these differences are not sufficiently extensive to be the principal cause of the variations experienced by manufacturers. It is proposed to continue the study of variations in plasticity with the general study of variability referred to above, and to ascertain which estates are producing rubber with abnormal plasticity and to determine the cause.

The important question of the effect of storage on the plasticity of rubber has again received considerable attention. The investigation is being continued and some time must necessarily elapse before it is completed.

As in previous years the staff in London co-operated with the Chemist in Ceylon in the examination of a number of samples received in connection with his investigations in Ceylon.

The following reports were forwarded to Ceylon during the year:—

(*a*) Effect of organic accelerators of vulcanisation on the variability of rubber (Published in the 1st. Quarterly Circular, 1929).

(*b*) The determination of the plasticity of rubber (Published in the 1st. Quarterly Circular, 1929).

(*c*) Crepe prepared by fractional coagulation.

(*d*) Comparison of Revertex and smoked sheet in a tyre-tread mixing.—Report of the Research Association of British Rubber Manufacturers in collaboration with the Committee.

Further information regarding the investigations is given in the Appendix.

J. A. NELSON,
Secretary.

(Signed) P. J. BURGESS,
Chairman.

IMPERIAL INSTITUTE,
LONDON, S. W. 7.
23rd. January, 1930.

APPENDIX TO ANNUAL REPORT OF THE LONDON COMMITTEE FOR 1929.

(1) **The Effect of Standardisation of Estate Factory Practice on Variability.**—The use of plantation rubber would be greatly facilitated if first grade material were uniform in its chemical and physical properties irrespective of its origin. Most of the work on causes of variation has been concerned with a study of the factors in preparation which affect the quality of the product, with a view to achieving uniformity by the standardisation of factory procedure, but little has been done to ascertain the degree of uniformity attained when exactly the same method of preparation is adopted on a number of estates.

Experiments carried out by the Scheme some years ago showed that rubber from single groups of trees was fairly uniform in rate of vulcanisation irrespective of the season of the year, but that rubber from some estates had very different rates of vulcanisation from rubber of other estates using exactly the same method of preparation. The uniformity of rubber from single estates has also been observed on numerous occasions in Java, and attempts have been made to obtain uniform material from different estates by altering the details of the method of preparation on the estates producing an abnormal product. It appears, therefore, that there are factors connected with the source of the material which are a cause of variability in rubber and these factors are now receiving special attention by the London Committee.

The samples from single groups of trees referred to above were prepared under scientific supervision, but although fairly uniform were not as uniform as the product of some estates in Java tested soon after preparation in that country. Accordingly before commencing the study of the differences between rubber from different estates in Ceylon, a preliminary investigation is being carried out to determine whether rubber from single estates is equally uniform in Java and Ceylon in rate of vulcanisation and in plasticity, and what changes take place in the properties of the rubber on storage in Europe and the tropics. For this purpose a series of thirty-six samples of crepe from Java representing twelve consignments at monthly intervals is being examined in comparison with ninety-six samples of crepe and sheet from Ceylon. The samples from Java are being examined immediately on arrival and after storage at 60°F for six and eighteen months. Similar tests are being carried out in Java except that the rubber is being stored under tropical conditions. The samples from Ceylon have been collected and prepared so that it is possible to make a comparison as regards uniformity between (*a*) rubber from a large and a small group of trees, (*b*) rubber prepared under estate supervision and that prepared under scientific control, (*c*) smoked sheet, smoked sheet containing paranitrophenol, air-dried crepe and machine-dried crepe.

At the end of the year twenty-seven samples from Java and forty-eight from Ceylon had been tested, and nine of the samples from Java had been re-tested after storage for six months.

The results of tests on the rubber from Java are on the whole in agreement with those obtained at the Central Rubber Station and are fairly uniform in respect of time of vulcanisation in a rubber-sulphur mixing as is also the rubber from Ceylon. The rubber from Ceylon vulcanised more slowly than that from Java. There is no indication that stricter supervision on estates will effect a marked improvement in uniformity. Rubber from the large estate is not more uniform than that from the small estate, but it is probable that rubber from large estates will conform more closely to the average for the Island.

No conclusions can yet be drawn as regards variations in plasticity or as regards the effect of storage on variability.

The tests on these samples are limited to a study of plasticity and rate of vulcanisation in a rubber-sulphur mixing, and these should be sufficient to indicate the inherent uniformity or otherwise of rubber from a single estate where the biological factors are constant. When comparing the product of different estates, however, it is possible for the rubber to be uniform according to the results of these tests and yet to be variable in manufacturing operations and in keeping properties when made into vulcanised rubber goods. In addition to sulphur, manufacturers use substances which exert a profound effect on the properties of rubber and some of the accessory substances present in raw rubber respond differently in different mixings.

As a result of several years' work by the staff in London on the effect of accessory substances on the vulcanisation of the most prevalent type of technical mixing (*i.e.*, one containing zinc oxide and an organic accelerator in addition to rubber and sulphur), it is now possible to put forward general conclusions which will be of considerable help in studying the differences between rubber from different estates. These conclusions may be summarised as follow.

1. (*a*) Some of the acetone-soluble constituents (fatty acids) of raw rubber have a marked effect on the vulcanising properties of mixings containing an organic accelerator and small quantities of zinc oxide. The effect of these constituents is much less when large quantities of zinc oxide are present.

(*b*) A series of tests indicated that the extent of variation in the acetone-soluble constituents of first grade rubber is not sufficient to cause serious variation in vulcanising properties. Inferior grades would probably give variable results.

2. (*a*) Mixings containing the proportions of accelerator and sulphur employed in factory practice show some variation according to the origin of the raw rubber used. The cause of this variation has not been determined, but is probably connected with the serum substances.

(*b*) When accelerator mixings contain about twice the amount of sulphur usually employed in factory practice, all samples of first grade rubber give uniform results.

Further work is necessary to elaborate and confirm these conclusions.

During 1929 particular attention was devoted to the effect of acetone-soluble constituents of rubber on accelerator mixings containing large and small quantities of zinc oxide (*see conclusion in 1 (a) above*). Experiments with a wide range of accelerators showed in every case except one that those acetone-soluble constituents which had such a marked effect in the presence of small quantities of zinc oxide had little effect in the presence of large quantities. Mixings containing small quantities of zinc oxide are frequently employed in manufacturing practice, and it is proposed to extend the investigation to determine the extent of the variation in this type of mixing with samples from different estates, with a view to confirming the conclusion in 1 (*b*) above, and to correlate the results with analytical data from the acetone-soluble constituents and with vulcanising properties in a rubber-sulphur mixing.

The artificial ageing properties of the samples will also be studied.

Plasticity.—Since the study of this subject was commenced, a large amount of work of a preliminary character has had necessarily to be undertaken. This has now been mostly completed and conclusions which should be of practical value to estates are beginning to be obtained.

The comprehensive investigation referred to in the report for 1928 on the effect of a variety of factors connected with estate pratctice was concluded. The results of individual experiments have been mentioned in previous reports, but it has not hitherto been possible to review them as a whole. It was first shown that there was an appreciable amount of variation in the plasticity of the same form of rubber from different estates and this variation had a rough correlation with the rate of vulcanisation in a rubber-sulphur mixing. The variation does not appear to be explained by differences likely to arise in estate factories as many of the factors studied had no effect on plasticity and none had an effect of sufficient magnitude to explain the differences between rubber from different estates. For example, although crepe from latex diluted to 5 per cent dry rubber content is fairly soft, there is little difference between crepe from latex containing 15 per cent dry rubber and that from latex containing 25 per cent dry rubber. Similarly, rolling coagulum forty times through crepe rollers causes the dry rubber to be very soft, but coagulum rolled twenty times and that rolled five times produce rubber not markedly different in plasticity. The addition of bisulphite to latex for crepe manufacture has a hardening effect, but for various reasons no estate is likely to use the excessive amounts required to produce differences similar to those occurring between rubber from different estates. Blanketing dry crepe has a softening effect which may be marked, but this will not account for differences between estate smoked sheets which are more variable than the crepes. Machine-dried crepe (afterwards blanketed) is always a little softer than air-dried crepe (also blanketed), but a single experiment with air-dried sheet did not indicate that the temperature of drying (85-185°F) had any effect.

As the differences in plasticity between estate rubbers do not appear to be caused by differences in factory practice it is possible that they are due to differences between the latex from different groups of trees, and it is proposed to investigate this possibility.

It was at one time thought that as the plasticity of rubber changes on keeping, the differences observed between rubbers from different estates might be due to the fact that the samples examined were stored two years before the plasticity tests were sufficiently developed to commence the investigation. Nearly all samples are now divided into two portions and stored for six months at 32°F and 60°F respectively before testing. In almost every case the portion stored at 60°F is a little harder than that stored at 32°F. The results indicate that although it is important to define conditions of storage for the exact determination of plasticity, they are not the chief cause of differences between rubbers from different estates.

It is desirable, however, to carry out further tests at temperatures up to 80°F under a variety of humidity conditions before drawing general conclusions. This has not yet been practicable owing to the amount of rubber and time required for such an elaborate series of tests. The amount of rubber required for each test has now been considerably reduced and the speed of testing increased so that it should be possible to carry out more comprehensive storage tests when the next series of samples are received.

A series of samples of smoked sheet, some containing paranitrophenol, were stored for six months under a variety of conditions and their plasticity determined without mastication. All the samples became very hard when kept either dry or wet (96 per cent saturation) and were harder after storage in oxygen than in nitrogen. Samples kept under intermediate conditions of moisture (38 per cent—80 per cent saturation) showed little change. The results indicate that if sheet is accidentally wet and allowed to remain in that condition the rubber is likely to become hard and cause trouble during manufacturing operations.

(3) **Co-operation in experiments initiated by the Chemist in Ceylon.**

(*a*) **Air-dried sheet.**—Owing to the increasing cost of firewood in Ceylon experiments are being caried out by Mr. O'Brien (the Chemist in Ceylon) with a view to enabling estates to market a satisfactory form of rubber, the preparation of which will not require as much firewood as is the case with smoked sheet. The quality of this rubber and the problems connected with marketing are receiving attention in London.

A sample of sheet dried in air at atmospheric temperature and containing paranitrophenol to prevent mould, which was received in connection with preliminary experiments, was of good appearance and had excellent physical properties. Owing to the time required for drying, this method of preparation is not practicable on a large scale and experiments have since been made in which the rubber was dried at a slightly higher temperature. These samples were found on examination not to be of such good quality.

Whilst in Ceylon Mr. Martin, the Chief Chemist in London, discussed the problems involved with Mr. O'Brien who has arranged a further series of experiments.

(*b*) **Crepe prepared by fractional coagulation.**—At the request of Mr. O'Brien a study has been made of the properties of crepe prepared by fractional coagulation. This method is usually employed for the manufacture of sole crepe as the second fraction is very pale. Mr. O'Brien wished to determine whether fractional coagulation could be profitably adopted for the manufacture of ordinary blanket crepe, particularly on estates which consistently produce crepe of poor appearance by ordinary methods. The first fraction amounts to about 10 per cent of the total rubber in the latex and, on account of its yellow colour, sells at a discount of approximately 10 per cent. below the market price of standard crepe.

Both fractions had excellent vulcanising, mechanical and ageing properties, though differing somewhat in chemical compositton. A broker's valuation indicated that the first fraction would not command full market price on account of its colour, and the second fraction was not likely to obtain a premium in the form of blanket crepe.

The results of the examination in London suggested that both fractions may possibly be specially suitable for the manufacture of certain materials. The subject is being further investigated in conjunction with manufacturers, and if the experiments now in progress give promising results technical trials will be arranged.

(Signed) P. J. BURGESS,
Chairman.

J. A. NELSON,
Secretary.

IMPERIAL INSTITUTE,
LONDON, S. W. 7.
23rd. January, 1930.

APPENDIX A.

LIST OF MEMBERS.

Members of Rubber Growers' Association.

Aboyne-Clyde Rubber Estates of Ceylon, Ltd.
Alliance Tea Company of Ceylon, Ltd.
Alluta Rubber and Produce Co., Ltd.
Amalgamated Tea Estates Co., Ltd.
Anglo-American Direct Tea Trading Co., Ltd.
Anglo-Ceylon and General Estates Co., Ltd.
Associated Tea Estates of Ceylon, Ltd.
Bandarapola Ceylon Co., Ltd.
Beau Sejor Rubber Co., Ltd.
Beverley Tea and Rubber Estates, Ltd.
Caledonian (Ceylon) Tea and Rubber Estates, Ltd.
Carolina Tea Company of Ceylon, Ltd.
Central Province Ceylon Tea Co., Ltd.
Ceylon (Bibile) Rubber Estates, Ltd.
Ceylon Consolidated Estates (1920), Ltd.
Ceylon (Para) Rubber Co., Ltd.
Ceylon Proprietary Tea Estates, Co., Ltd.
Ceylon Planters' Rubber Syndicate, Ltd.
Ceylon Rubber Co., Ltd.
Ceylon Tea Plantations Co., Ltd.
Ceylon Timber and Rubber Syndicate, Ltd.
Colombo Commercial Co., Ltd.
Consolidated Estates Co., Ltd.
Consolidated Tea and Lands Co., Ltd.
Dalkeith (Ceylon) Rubber Estates, Ltd.
Dangan Rubber Estates, Ltd.
Deviturai Rubber and Tea Estates Co., Ltd.
Dickella (Ceylon) Rubber Estates, Ltd.
Dimbula Valley (Ceylon) Tea Co., Ltd.
Doloswella Rubber and Tea Estates, Ltd.
Doone Vale (Ceylon) Rubber Co., Ltd.
Doranakande Rubber Estates, Ltd.
Eastern Produce and Estates Co., Ltd.
East India and Ceylon Tea Co., Ltd.
Ederapolla Tea Co. of Ceylon, Ltd.
Elmshurst (Ceylon) Tea and Rubber Co., Ltd.
Elston Estates Company of Ceylon, Ltd.
Frocester Estate Rubber Co., Ltd.
Galaha Ceylon Tea Estates and Agency Co., Ltd.
Galphele Tea and Rubber Estates, Ltd.
General Ceylon Rubber and Tea Estates, Ltd.
Glen Rubber and Tea Co., Ltd.
Glendon Rubber Co., Ltd.
Gonagama Rubber Co., (Ceylon) Ltd.
Govinna Rubber Co., Ltd.
Grand Central(Ceylon)Rubber EstatesCo.,Ltd.
Hanipha Ceylon Tea and Rubber Co., Ltd.
Hanwella Rubber Estates, Ltd.
Hewagam Rubber Co., Ltd.
Higgoda Rubber Estates, Ltd.
Honiton Rubber Co., Ltd.
Hunasgeria Tea Co., Ltd.
Igalkande Rubber and Tea Estates, Ltd.
Imperial Ceylon Tea Estates, Ltd.
Kandy Rubber and Tea Estates, Ltd.
Kelani Valley Rubber Estates, Ltd.
Kepitigalla Rubber Estates, Ltd.
Kintyre Tea Estates Co., Ltd.
Knavesmire Estates Co., Ltd.
Kudaganga Rubber Co. of Ceylon, Ltd.
Kurunegala Rubber Co., Ltd.
Lanka Rubber Co., Ltd.
Lanka Plantations Co., Ltd.
Lavant Rubber and Tea Co., Ltd.
Lochnagar (Ceylon) Produce Co., Ltd.
Lowmont Estates Co., Ltd.
Lunuva (Ceylon) Tea & Rubber Co., Ltd.
Mahawale Rubber and Tea Co., Ltd.
Mapalagama Rubber Estates, Ltd.
Mirishena (Kalutara) Rubber Co., Ltd.
Monerakelle Rubber Estates, Ltd.
Nagolle (Ceylon) Rubber and Tea Plantations, Ltd.
Nahalma Tea Estates Co., Ltd.
Narangoda Rubber Co., Ltd.
Nayabedde Estates Co., Ltd.
Neboda (Ceylon) Rubber & Tea Estates, Ltd.
Ouvah (Ceylon) Estates, Ltd.
Panagula Rubber Co., Ltd.
Panawal Tea Co., Ltd.
Panawatte Tea and Rubber Estates, Ltd.
Pantiya Tea and Rubber Co., Ltd.
Parambe Rubber and Tea Co. of Ceylon, Ltd.
Pelmadulla Rubber Co., Ltd.
Pelmadulla Valley Tea and Rubber Co., Ltd.
Pimbura Rubber Co., Ltd.
Pindenioya Rubber and Tea Estates, Ltd.
Pitakande Tea Co. of Ceylon, Ltd.
P. P. K. (Ceylon) Rubber Estates, Ltd.
Ragalla Tea Estates, Ltd.
Remuna Rubber Co., Ltd.
Rosehaugh (Ceylon) Rubber Co., Ltd.
Rubber Estates of Bentota, Ltd.
Rubber Estates of Ceylon, Ltd.
Saffragam Rubber and Tea Co. of Ceylon, Ltd.
St. George Rubber Estates, Ltd.
Standard Tea Co. of Ceylon, Ltd.
Sunnygama Co., Ltd.
Telbedde (Ceylon) Estates, Ltd.
Tempo Tea and Rubber Co., Ltd.
United Planters' Co., of Ceylon, Ltd.
Vogan Tea Co. of Ceylon, Ltd.
Woodend(Kelani Valley,Ceylon) Rubber and Tea Co., Ltd.
Yataderiya Rubber and Tea Co., Ltd.
Yatiyantota (Ceylon) Tea Co., Ltd.

LOCAL SUBSCRIBERS.—(Companies).

Ambalawa Estate Co. of Ceylon, Ltd.
Ankande Estate Co. of Ceylon, Ltd.
Apthorpe Estates, Ltd.
Aranayaka Rubber Co., Ltd.
Atherfield Tea and Rubber Co., Ltd.
Avington Tea and Rubber Co., Ltd.
Ceylon AmalgamatedTea & Rubber Co., Ltd. (*ceased.* 1-10-29.)
Ceylon Land and Produce Co., Ltd.
Clunes Estates Company of Ceylon, Ltd.
Cocoawatte (Ceylon) Rubber and Tea Estates, Ltd.
Colombo Commercial Co., Ltd.
Cullen Estates, Ltd.
Damblagolla Rubber Estates, Ltd.
Diwala (Kegalla) Rubber Co., Ltd.
Dorset Rubber Estate Co., Ltd.
Eila Tea Co., Ltd.
Estates Co. of Uva, Ltd.
Farnham Estate Co., Ltd.
Fernlands Tea Co., Ltd.
Gallebodda Estate Co. of Ceylon Ltd.
Gallawatte (Ceylon) Rubber Co., Ltd.
Ganapalla Estate Co., Ltd.
Giragoda Rubber Co., Ltd.
Golinda Tea and Rubber Co , Ltd.
Hantane and Bollagalla Estates Co., Ltd.
Hatbawe Rubber Co., Ltd.
Haydella Tea and Rubber Estates, Ltd.
Hinwerelle Rubber Co., Ltd.
Horawala (Kalutara) Rubber Co., Ltd.
Hulandawa Rubber & Tea Co., (Ceylon)
Hunuwella (Pelmadulla) Rubber Co., Ltd.
Jambulande Tea and Rubber Estates, Ltd.
Kaluganga Valley Tea & Rubber Co., Ltd.
Kalutara Co., Ltd.
Kalutara Rubber Co. of Ceylon, Ltd.
Kandyan Hills Co., Ltd.
Karandupona Estates Co., Ltd.
Katiapola Rubber Co., Ltd.
Kelani Tea Garden Co., Ltd.
Kelani Valley Rubber Co. of Ceylon, Ltd.
Kinnersley (Kalutara) Rubber Co., Ltd.
Kiriella Estate Co., Ltd.
Kuttapitiya Tea and Rubber Co., Ltd.
Lagos (Ceylon) Rubber Co., Ltd.
Lansdowne Rubber Co., Ltd.
Lassahena Rubber Co., Ltd.
L. L. P. Estates, Ltd.
Lipton, Ltd.
Lunugala Tea and Rubber Co., Ltd.
Lyegrove Rubber Co., Ltd.
Macaldeniya Tea and Rubber Co., Ltd.
Mafalda Rubber Syndicate.*
Mahagama Rubber Co., Ltd.
Meall Mor (Ceylon) Estates, Ltd.
Mocha Tea Co. of Ceylon, Ltd.
Moneragalla Rubber Co., Ltd.
Morakelle Rubber Co., Ltd.
Neuchatel Estates, Ltd.
Niriwatte Co., Ltd.
North Western Rubber Co., Ltd.
Opalgalla Tea and Rubber Estates, Ltd.
Opata Tea and Rubber Co., Ltd.
Panana (Kegalla) Rubber Co., Ltd.
Peacock and Nilambe (Ceylon) Tea and Rubber Estates, Ltd.
Piccadilly (Kelani Valley, Ceylon) Rubber and Tea Estates, Ltd.
Pine Hill Estates Co., Ltd.
Poonagalla Valley, (Ceylon) Co., Ltd.
Ragama Tea and Rubber Co., Ltd.
Ratwatte Cocoa Co., Ltd.
Rayigam Co., Ltd.
Ruanwella Tea Co., Ltd.
Rubber Plantations of Kalutara Ltd.
Rubber Securities Ltd.*
Ryan's Estates of (Ceylon,) Ltd.
Sheldon Estates, Ltd.
Sitawaka Tea and Rubber Co., Ltd.
Sunderland (Ceylon) Rubber Co., Ltd.
Syston Estates Co. of Ceylon, Ltd.
Tannahena Rubber Estates, Ltd.
Tillyfour Rubber Co., Ltd.
Udabage Tea and Rubber Co., Ltd.
Udagoda Tea and Rubber Co., Ltd.
Udakelle Rubber Co., Ltd.
Udapolla Rubber Co., Ltd.
Ullswater Rubber Co. of Ceylon, Ltd.
Usk Valley (Kalutara) Rubber Co., Ltd.
Uva Rubber Co. of Ceylon, Ltd.
Vauxhall Rubber Co., Ltd.
Vincit Tea and Rubber Co., Ltd.
Walakande Rubber Co., Ltd.
Walker, Sons, & Co., Ltd.
Warriapolla Estates Co., Ltd.
Watapota Rubber and Tea Estates, Ltd.
Wellandura Tea and Rubber Co., Ltd.
Weniwella Rubber Co., Ltd.

*New Subscribers for 1929.

LOCAL SUBSCRIBERS (INDIVIDUALS.)

E. G. Adamaly & Co., ...	Alavi Estate.
C. E. A. Dias, Esq., J. P.	Mukalana and Wawulugala Estates.
The Rt. Hon. Lord Elphinstone, ...	Gikiyanakande Estate.
E. C. de Fonseka, Esq., M.B.E., ...	Silverdale Estate.
C. F. Hutchinson, Esq., ...	Mapitigama Estate.
Sir H. M. Mallaby-Deely, Bart., ...	Ambanpitiya Estate.
Mackwoods, Ltd., ...	Guava Hill Estate.
Mackwoods, Ltd., ...	Cattarattenna, Hylton & Imboolpitiya Estates.
Mrs. A. S. Orchard, ...	Ilwana Estate.
Messrs. Wilmot A. and Leslie R. Perera, ...	Hegalla Estate.
Lambert L. Pieris, Esq., ...	Bibilioyatenne Estate.
N. D. S. Silva, Esq., ...	Silvaland Estate.
L. W. A. de Soysa, Esq., ...	Paradise and Nugahena Estates.
R. E. S. de Soysa, Esq., ...	Nella Olla Estate, (*ceased 1. 7. 29.*)
John H. Starey, Esq., ...	Tudugalla Estate.
A. Sykes, Esq., ...	Duhallow Estate.
W. W. Sevier, Esq., ...	*Mousagalla Estate.

*New Estate for 1929.

APPENDIX B.

CIRCULARS.

No.	
1.	Research Work in Ceylon (17-2-21).
2.	Budding and Grafting of Rubber (2-9-21).
3.	Research Work in Ceylon (5-9-21).
4.	Scale of Subscriptions (27-2-22).
5.	Research Work in Ceylon (1-7 22)
6.	Rust and Mould on Sheet Rubber.
7.	Research Work in Ceylon.
8.	Shipment of Latex.
9.	First Quarterly Circular for 1924.
10.	Second Quarterly Circular for 1924.
11.	Third Quarterly Circular for 1924.
12.	Fourth Quarterly Circular for 1924.
13.	First Quarterly Circular for 1925.
14.	Second Quarterly Circular for 1925.
15.	Third Quarterly Circular for 1925.
16.	Fourth Quarterly Circular for 1925.
17.	First Quarterly Circular for 1926.
18.	Second Quarterly Circular for 1926.
19.	Third Quarterly Circular for 1926.
20.	Fourth Quarterly Circular for 1926.
21.	First Quarterly Circular for 1927.
22.	Second Quarterly Circular for 1927.
23.	Third Quarterly Circular for 1927.
24.	Fourth Quarterly Circular for 1927.
25.	First Quarterly Circular for 1928.
26.	Second Quarterly Circular for 1928.
27.	Third Quarterly Circular for 1928.
28.	Fourth Quarterly Circular for 1928.
29.	First Quarterly Circular for 1929.
30.	Second Quarterly Circular for 1929.
31.	Third Quarterly Circular for 1929.
32.	Fourth Quarterly Circular for 1929.

APPENDIX C.

BULLETINS.

No. 1. The Effect of Tapping on the Movements of Plant-Food in Hevea brasiliensis.
„ 2. The Effect of Tapping on the Movements of Plant-Food in Hevea brasiliensis (continued).
„ 3. Seasonal Variations in the Movements of Plant-Food in Hevea brasiliensis, Part I
„ 4. The Physiological Effects of Various Tapping Systems, Part I.
„ 5. Progress Report on Vulcanization Tests.
„ 6. The Physiological Effects of Various Tapping Systems, Part II.
„ 7. The Physiological Effects of Various Tapping Systems, Part III.
„ 8. Seasonal Variations in the Movements of Plant-Food in Hevea brasiliensis, Part II.

No. 9. Vulcanization Tests.
„ 10. Vulcanization Tests.
„ 11. Variability in Rubber Manufacture.
„ 12. Progress Report of the Rubber Research Chemist.
„ 13. Vulcanization Tests.
„ 14. On the Variation in the Number of Latex Vessels present in Hevea brasiliensis.
„ 15. Vulcanization Tests.
„ 16. On the Natural Clotting of Rubber Latex.
„ 17. Vulcanization Tests.
„ 18. Measurements of "Bark Renewal".
„ 19. Vulcanization Tests.
„ 20. Vulcanization Tests.
„ 21. Vulcanization Tests.
„ 22. Vulcanization Tests.
„ 23. Vulcanization Tests.
„ 24. Vulcanization Tests.
„ 25. Vulcanization Tests.
„ 26. Results of the Trials of Ceylon Rubber for the Manufacture of Ebonite.
„ 27. Vulcanization Tests.
„ 28. Vulcanization Tests.
„ 29. Summary of Results of Vulcanization Tests.
„ 30. The Penetration of Disinfectants on the Tapping Cut of Hevea.
„ 31. On the Occurrence of Rust on Sheet Rubber.
„ 32. On the "Preservation of Latex."
„ 33. Variability of Plantation Rubber, 1st Interim Report (New Series).
„ 34. Variability of Plantation Rubber, 2nd Interim Report (New Series).
„ 35. Variability of Plantation Rubber, 3rd Interim Report (New Series).
„ 36. Variability of Plantation Rubber, 4th Interim Report (New Series).
„ 37. Variability of Plantation Rubber, 5th Interim Report (New Series).
„ 38. Variability of Plantation Rubber, 6th Interim Report (New Series).
„ 39. Variability of Plantation Rubber, Final Report (New Series).
„ 40. Vulcanizing and Mechanical Properties of Wet Rubber.
„ 41. First Interim Report on Artificial Ageing Tests on Plantation Rubber.
„ 42. On the Smoking of Sheet Rubber in Relation to Mould Prevention.
„ 43. The Inter-relationship of Yield and the various Vegetative Characters in Hevea brasiliensis.
„ 44. The Construction of Smoke-houses for Small Rubber Estates.
„ 45. The Efficiency of Disinfectants and Fungicides.
„ 46. The Control of Bark Rot by Disinfectants.
„ 47. On the Variability of Ceylon Estate Grades.
„ 48. Brown Bast and its Treatment.
„ 49. Causes of Variation in Plasticity.
„ 50. Crepe Rolling.

APPENDIX D.

SCALE OF ANNUAL SUBSCRIPTIONS.

					£.	s.	d.
No. Output ...	...	...	...		10	10	0
Output up to and not exceeding		100,000 lbs.	...		15	15	0
Exceeding 100,000 lbs.	not exceeding	200,000	„	...	21	0	0
Do 200,000 „	do	300,000	„	...	26	5	0
Do 300,000 „	do	400,000	„	...	31	10	0
Do 400,000 „	do	500,000	„	...	36	15	0
Do 500,000 „	do	600,000	„	...	42	0	0
Do 600,000 „	do	700,000	„	...	47	5	0
Do 700,000 „	do	—	„	...	52	10	0

For conversion purposes the rate of exchange is the Bank's selling rate for Demand Drafts on London on 15th January or July respectively.

Appendix D.

RUBBER RESEARCH SCHEME (Ceylon.)
ESTIMATES OF INCOME AND EXPENDITURE
FOR 1930.

REVENUE STATEMENT.

CEYLON.

	Rs.	c.	Rs.	c.
Balance at December 31st, 1929			59,755	65
Income for 1930.				
Government Grant for 1930	50,625	00		
Local Subscriptions 1930	34,000	00		
Rent of Bungalows on Culloden	1,956	00		
Interest on Fixed Deposits	1,800	00		
„ Current Account	300	00		
			88,681	00
TOTAL Rs. ...			148,436	65

LONDON.

	£.	s.	d.
Balance at December 31st, 1929	460	5	9
Income for 1930.			
Contribution from Rubber Growers' Association	2,000	0	0
Remittance from Ceylon Committee	540	0	0
Interest on balances	25	0	0
.	3,025	5	9

EXPENDITURE STATEMENT.

CEYLON.

		Rs.	c.	Rs.	c.
1.	**Personal Emoluments.**				
	(*a*) Salaries and wages	43,967	00		
	(*b*) House allowances	772	00		
				44,739	00
2.	**Laboratory.**				
	(*a*) Chemicals and laboratory upkeep	2,750	00		
	(*b*) Apparatus from London	1,500	00		
	(*c*) Samples for Imperial Institute	750	00		
	(*d*) Manuring experiments (Oidium)	300	00		
	(*e*) Spraying experiments (Oidium)	100	00		
	(*f*) Dusting experiments (Oidium)	2,075	00		
	(*g*) Proposed manuring experiments	1,840	00		
	(*h*) Routine tests on chemicals	200	00		
				9,515	00
3.	**Buildings.**				
	(*a*) Upkeep	1,500	00		
	(*b*) Insurances	316	00		
	(*c*) Upkeep of water supplies	550	00		
	(*d*) Furniture	300	00		
				2,666	00
4.	**Office.**				
	(*a*) Printing, Stationery, Advertising	2,000	00		
	(*b*) Furniture	200	00		
	(*c*) New typewriter	350	00		
	(*d*) Books and Periodicals	500	00		
				3,050	00
5.	**Travelling.**				
	Subsistence allowances and travelling of all officers and members of Executive and Technical Committees ...	7,600	00		
				7,600	00
6.	**Incidentals.**				
	(*a*) Postages and telegrams	1,200	00		
	(*b*) General charges	600	00		
	(*c*) Audit and accountancy	500	00		
				2,300	00
7.	Sinking Fund for bonuses and passages			10,000	00
8.	Upkeep of Road to bungalows and laboratory ...			700	00
9.	**Special Charges.**				
	(*a*) London expenditure	7,200	00		
				7,200	00
10.	**Experiment Station.**				
	(*a*) Development and upkeep	10,467	00		
	(*b*) Cart road upkeep	1,000	00		
				11,467	00
			TOTAL	99,237	00

EXPENDITURE STATEMENT.—*Contd.*

Summary for Ceylon.

	Rs.	c.
Balance at December 31st, 1929	59,755	65
Estimated receipts during 1930	88,681	00
	148,436	65
Estimated expenditure during 1930	99,237	00
Estimated balance at December 31st, 1930 ...	49,199	65

LONDON.

	£.	s.	d.
1. Salaries and wages	2,235	0	0
2. Postages and clerical assistance ...	50	0	0
3. Gas and electricity	110	0	0
4. Apparatus and chemicals	120	0	0
5. General charges	50	0	0
£.	2,565	0	0

Summary for London.

	£.	s.	d.
Balance at December 31st, 1929 ...	460	5	9
Estimated receipts during 1930 ...	2,565	0	0
	3,025	5	9
Estimated expenditure during 1930 ...	2,565	0	0
Estimated balance at December 31st, 1930 £.	460	5	9

SINKING FUND FOR BONUSES AND PASSAGES.

	Rs.	c.
Fund at December 31st, 1929	19,030	00
Payment to fund during 1930	10,000	00
Estimated interest during 1930	1,160	00
TOTAL Rs.	30,190	00

Disbursements from Fund during 1930.

Bonus to Mr. T. E. H. O'Brien	Rs. 9,540-00		
Passage to England and back Mr. & Mrs. O'Brien ...	„ 3,070-00	12,610	00
Estimated balance at December 31st, 1930 ...		17,580	00

These estimates were considered and approved at the meeting of the Executive Committee held on December 20th, 1929.

By order,

(Signed) J. I. GNANAMUTTU,
Secretary.

RUBBER RESEARCH SCHEME (CEYLON),
PERADENIYA.
17th March, 1930.

RUBBER RESEARCH SCHEME (CEYLON).

BALANCE SHEET 31st DECEMBER, 1929.

LIABILITIES.	Rs. c.	Rs. c.
Sundry Creditors.		
Local Accounts	119 86	
Duncum, Watkins, Ford & Co.	500 00	
		619 86
Permanent Reserve Account.		
As per last Balance Sheet		46,550 00
Reserve Fund for Bonus and Passages.		
As per last Balance Sheet	17,942 04	
Added this year	10,000 00	
Interest on Fixed Deposits added during the year ...	937 75	
	28,879 79	
Less Bonus and Passage of Organising Secretary paid.	9,087 43	
		19,792 36
SURPLUS ACCOUNT:		
Balance of Income and Expenditure.		
As per last Balance Sheet	149,606 24	
Less Excess of Expenditure over Income year 1929 as per Account Rs. 1,801-31		
„ Transferred during the year to Reserve for Bonus and Passages „ 10,000-00		
	11,801 31	
		137,804 93
Rs.		204,767 15

ASSETS.	Rs. c.	Rs. c.
Land Acquisition Account.		
As per last Balance Sheet		984 07
Buildings Account.		
As per last Balance Sheet	59,743 03	
Add Expenditure during the year	267 67	
	60,010 70	
Less Depreciation written off	6,001 07	
	54,009 63	
Add Lightning Conductor purchased in December, 1929	300 00	
„ Expenditure on Heating Apparatus for Smoke Houses	1,520 62	
		55,830 25
Water Supply.		
As per last Balance Sheet	2,736 65	
Less Depreciation written off	273 66	
		2,462 99
Laboratory Apparatus, etc.		
As per last Balance Sheet	6,333 35	
Add Expenditure during the year	1,577 24	
	7,910 59	
Less Depreciation written off	1,977 64	
	5,932 95	
Add One Bjorklund Duster purchased in December, 1929	968 63	
		6,901 58
Furniture, Fittings & Office Equipment. (*including Furniture and Fittings at Laboratory*).		
As per last Balance Sheet	7,474 23	
Add Expenditure during the year	1,465 36	
	8,939 59	
Less Depreciation written off	893 95	
		8,045 64
London Plant Account.		
As per last Balance Sheet	6,289 64	
Less Proceeds of Sale of Vulcanizing Pan ...	106 67	
	6,182 97	
Less Depreciation written off	1,333 33	
		4,849 64
Motor Car Account.		
As per last Balance Sheet	1,968 75	
Less Depreciation written off	1,697 25	
		271 50
Expenditure in connection with Experimental Station.		
Amount brought forward from last year ...	46,899 99	
Expenditure on Development during the year:		
1926 Clearings 2,061-04		
1927 do 2,727-94		
1928 do 5,043-46		
Budwood Nurseries ... 1,103-01		
Buildings, etc. 913-24		
	11,848 69	
		58,748 68
Payments in Advance.		
Insurance and Telephone rent	223 50	
Rent of Leases for 1930	6 00	
		229 50
Deposits.		
P. M. G. Telephone		10 00
Sundry Debtors.		87 86
Investment on account Bonus and Passage Reserve Fund.		
Cash on Fixed Deposit at National Bank of India, Limited		19,000 00
Cash.		
On Fixed Deposit at National Bank of India, Limited	40,000 00	
Interest accrued on above	399 45	
On Current Account	755 65	
In hand	33 70	
do (Experiment Station)	40 71	
In hands of Department for Overseas Trade London £460-5-9 @ 1/6 1/16	6,115 93	
		47,345 44
Rs.		204,767 15

We have audited the books of the Rubber Research Scheme (Ceylon) for the twelve months ended 31st December, 1929, in which are incorporated the Returns received from London for that period, and, subject to our Report dated 5th April, 1930, addressed to the Committee, in our opinion, the above Balance Sheet correctly sets forth the position of the Scheme's affairs at 31st December, 1929, according to the information and explanations given to us and as shewn by the books.

(Signed) DUNCUM, WATKINS, FORD & Co.,
Chartered Accountants,
Auditors.

Colombo, 5th April, 1930.

(Signed) W. SMALL,
Acting Chairman,
Executive Committee.

(Signed) J. I. GNANAMUTTU,
Secretary.

RUBBER RESEARCH SCHEME (CEYLON).

Dr. INCOME AND EXPENDITURE ACCOUNT for the year ended 31st DECEMBER, 1929. Cr.

To *Salaries and Wages :—*			Rs.	c.	Rs.	c.	
Technical Officers			31,222	36			
Organising Secretary :—							
Salary for period 1st January to 9th October, 1929 ...	16,258-06						
Leave pay for three months ...	5,250-00						
			21,508	06			
Secretary —October to December			1,125	00			
House Allowances			1,551	38			
Salaries (including Bonuses of Clerical Staff) ...			2,939	50			
Salaries of Laboratory Attendants, Watchers, Coolies, etc.			2,135	30			
					60,481	60	
„ Rent of Leases			8	00			
„ Printing and Stationery			2,238	22			
„ Cost of 1,000 Copies of Guide to Preparation of Rubber	880	00					
Less Proceeds of Sale of 33 copies ...	82	50					
			797	50			
„ Postages and Telegrams, etc.			1,295	43			
„ Subscriptions to Periodicals			355	59			
„ Travelling Expenses			5,346	93			
„ Running Expenses of Motor Car (including Insurance and Driver's Wages)			3,412	70			
„ Insurance of Buildings, etc.			313	81			
„ Telephone			125	00			
„ Transport Charges			479	65			
„ Sundry Charges			461	42			
„ Audit Fee and Accountancy Charges			500	00			
					15,334	25	
„ Chemicals for and upkeep of Laboratory ...			1,646	01			
„ Cost of preparing Samples for London			942	57			
„ Manuring Experiments			588	92			
„ Spraying Experiments			1,369	21			
					4,546	71	
„ Upkeep and Repairs of Buildings			1,341	38			
„ Upkeep of Heating Apparatus for Smoke Houses ...			100	00			
„ Upkeep and Repairs of Roads			683	43			
„ Upkeep Charges Experiment Station			223	12			
„ Repairs to Water Supply and Cost of Pumping ...			631	86			
					2,979	79	
„ *Rubber Conference in Java:*							
Expenditure in connection with London Delegates' visit to Ceylon, etc.							
Contribution to Mr. Lord's Expenses ...			750	00			
Allowances and Travelling Expenses of Mr. G. Martin			5,537	04			
					6,287	04	
„ *Depreciation written off:*							
Buildings			6,001	07			
Water Supply			273	66			
Laboratory Apparatus			1,977	64			
Furniture			893	95			
Motor Car			1,697	25			
					10,843	57	
„ *Expenditure in London for the year as per Returns from London:*							
Salaries of Technical Officers			27,145	92			
Secretarial			3,333	36			
Gas, Electricity, etc.			1,561	73			
Chemicals, Apparatus, etc.			1,768	67			
Petty Expenses			540	65			
Depreciation written off Plant in London £ 100/- ...			1,333	33			
			35,683	66			
Less Bank Interest	273-78						
„ Exchange adjustment ...	20-99						
			294	77			
					35,388	89	
				Rs.	135,861	85	

			Rs.	c.	Rs.	c.	
By *Grants :*							
From Ceylon Government, 1929			67,500	00			
From Rubber Growers' Association £ 2,000/- @ 1/6 ...			26,666	66			
					94,166	66	
„ *Subscriptions :*							
From Local Members, 1929					35,969	50	
„ Rent of Bungalows—amount recovered					1,873	34	
„ Subscriptions to Bulletins					443	85	
„ Interest on Fixed Deposits, etc.					1,607	19	
„ Balance as per Balance Sheet, being excess of Expenditure over Income for the year					1,801	31	
				Rs.	135,861	85	

Audited and found correct :

(Signed) DUNCUM, WATKINS, FORD & Co.,
Chartered Accountants,
Auditors.

Colombo, 5th April, 1930.

(Signed) W. SMALL,
Acting Chairman,
Executive Committee.

(Signed) J. I. GNANAMUTTU,
Secretary.